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TRANSACTIONS

OF THE

AMERICAN FISHERIES SOCIETY

AT ITS

FORTY-SECOND ANNUAL MEETING

September 3, 4 and 5, 1912

STANFORD LIBRARY

AT

DENVER, COLORADO

WASHINGTON
PUBLISHED BY THE SOCIETY
1913

Officers

1911-1912

Elected at the Forty-first Annual Meeting in St. Louis, Mo., for the ensuing year, including the meeting to be held in Denver, Colo., beginning September 3, 1912.

President.....S. F. FULLERTON, St. Paul, Minn.
Vice-President.....CHARLES H. TOWNSEND, New York City
Recording Secretary.....WARD T. BOWER, Washington, D. C.
Assistant Recording Secretary....ETHEL M. SMITH, Washington, D. C.
Corresponding Secretary.....HUGH M. SMITH, Washington, D. C.
Treasurer.....C. W. WILLARD, Westerly, R. I.

Vice-Presidents of Divisions

Fish Culture.....JOHN W. TITCOMB, Lyndonville, Vt.
Aquatic Biology and Physics.....EDWIN LINTON, Washington, Pa.
Commercial Fishing.....A. B. ALEXANDER, Washington, D. C.
Angling.....H. WHEELER PERCE, Chicago, Ill.
Protection and Legislation.....T. S. PALMER, Washington, D. C.

Executive Committee

HENRY B. WARD, *Chairman*, Urbana, Ill.; DANIEL B. FEARING, Newport, R. I.; E. HART GEER, Hadlyme, Conn.; D. H. POWER, Suttons Bay, Mich.; A. R. WHITAKER, Phoenixville, Pa.; R. TYSON WHITE, Brooklyn, N. Y.; W. L. MAY, Denver, Colo.

1912-1913

Elected at the Forty-second Annual Meeting in Denver, Colo., for the ensuing year, including the meeting to be held at Boston, Mass., beginning September 8, 1913.

President.....CHARLES H. TOWNSEND, New York, N. Y.
Vice-President.....HENRY B. WARD, Urbana, Ill.
Recording Secretary.....WARD T. BOWER, Washington, D. C.
Assistant Recording Secretary.....
Corresponding Secretary.....GEORGE W. FIELD, Sharon, Mass.
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Executive Committee

DANIEL B. FEARING, *Chairman*, Newport, R. I.; N. R. BULLER, Harrisburg, Pa.; ERNEST SCHAEFFLE, San Francisco, Cal.; J. QUINCY WARD, Frankfort, Ky.; DWIGHT LYDELL, Comstock Park, Mich.; GEORGE W. MILES, Indianapolis, Ind.; GEORGE H. GRAHAM, Springfield, Mass.

228215

DR. HUGH M. SMITH

United States Commissioner of Fisheries

Deputy United States Commissioner of Fisheries, 1903-1913

[illegible] of Scientific Inquiry, United States Fish Commission, 1897-1903

[illegible] Division of Fisheries, United States Fish Commission, 1892-1

Secretary-General Fourth [illegible]ober, [illegible], Washington

Presider [illegible] 1908

Officers

1911-1912

Elected at the Forty-first Annual Meeting in St. Louis, Mo., for the ensuing year, including the meeting to be held in Denver, Colo., beginning September 3, 1912.

President.....S. F. FULLERTON, St. Paul, Minn.
Vice-President.....CHARLES H. TOWNSEND, New York City
Recording Secretary.....WARD T. BOWER, Washington, D. C.
Assistant Recording Secretary....ETHEL M. SMITH, Washington, D. C.
Corresponding Secretary.....HUGH M. SMITH, Washington, D. C.
Treasurer.....C. W. WILLARD, Westerly, R. I.

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Protection and Legislation.....T. S. PALMER, Washington, D. C.

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[illegible] B. [illegible], *Chairman*, Urbana, Ill.; DANIEL B. [illegible], Newport, R. I.; E. HART GEER, Hadlyme, [illegible]; D. H. POWER, Suttons Bay, Mich.; [illegible] R. [illegible], Phoenixville, Pa.; R. [illegible] WHITE, Brooklyn, N. Y.; [illegible] L. MAY, Denver, Colo.

1912-1913

Elected at the Forty-second Annual Meeting in Denver, [illegible] the ensuing year, including the meeting to be held [illegible], beginning September 8, 1913.

[illegible] CHARLES H. TOWNSEND, New York, N. Y.
[illegible].....HENRY B. WARD, Urbana, Ill.
[illegible] WARD T. BOWER, Washington, D. C.
[illegible].....
[illegible].....GEORGE W. FIELD, Sharon, Mass.
[illegible].....C. W. WILLARD, Westerly, R. I.

Vice-Presidents of Divisions

[illegible].....JAMES NEVIN, Madison, Wis.
[illegible].....[illegible] DYCHE, Pratt, Kan.
[illegible].....W. J. HUNSAKER, Saginaw, Mich.
[illegible] H. WHEELER PERCE, Chicago, Ill.
[illegible] T. S. PALMER, Washington, D. C.

Executive Committee

[illegible] Newport, R. I.; N. R. BULLER [illegible] SCHAEFFLE, San Francisco, Cal.; [illegible] Frankfort, Ky.; DWIGHT [illegible], [illegible] GEORGE W. M[illegible] [illegible] GEORGE H. GRAHAM, [illegible] Springfield, Mass.

DR. HUGH M. SMITH
United States Commissioner of Fisheries
Deputy United States Commissioner of Fisheries, 1903-1913
In charge of Scientific Inquiry, United States Fish Commission, 1897-1903
In charge Division of Fisheries, United States Fish Commission, 1892-1897
Secretary-General Fourth International Fishery Congress, Washington, 1908
President American Fisheries Society, 1908

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AMERICAN FISHERIES SOCIETY

Organized 1870

The first meeting of the Society occurred December 20, 1870. The organization then effected continued until February, 1872, when the second meeting was held. Since that time there has been a meeting each year, as shown below. The respective presidents were elected at the meeting, at the place, and for the period shown opposite their names, but they presided at the subsequent meeting.

PRESIDENTS, TERMS OF SERVICE, AND PLACES OF MEETING

1. William Clift.....1870-1872....New York, N. Y.
2. William Clift.....1872-1873....Albany, N. Y.
3. William Clift.....1873-1874....New York, N. Y.
4. Robert B. Roosevelt...1874-1875....New York, N. Y.
5. Robert B. Roosevelt...1875-1876....New York, N. Y.
6. Robert B. Roosevelt...1876-1877*...New York, N. Y.
7. Robert B. Roosevelt...1877-1878....New York, N. Y.
8. Robert B. Roosevelt...1878-1879....New York, N. Y.
9. Robert B. Roosevelt...1879-1880....New York, N. Y.
10. Robert B. Roosevelt...1881-1882....New York, N. Y.
11. Robert B. Roosevelt...1881-1882....New York, N. Y.
12. George Shepard Page.1882-1883....New York, N. Y.
13. James Benkard .....1883-1884....New York, N. Y.
14. Theodore Lyman.....1884-1885....Washington, D. C.
15. Marshall McDonald...1885-1886....Washington, D. C.
16. W. M. Hudson.....1886-1887....Chicago, Ill.
17. William L. May.....1887-1888....Washington, D. C.
18. John H. Bissell.....1888-1889....Detroit, Mich.
19. Eugene G. Blackford..1889-1890....Philadelphia, Pa.
20. Eugene G. Blackford..1890-1891....Put-in Bay, Ohio.
21. James A. Henshall....1891-1892....Washington, D. C.
22. Herschel Whitaker....1892-1893....New York, N. Y.
23. Henry C. Ford.....1893-1894....Chicago, Ill.
24. William L. May.....1894-1895....Philadelphia, Pa.
25. L. D. Huntington.....1895-1896....New York, N. Y.
26. Herschel Whitaker....1896-1897....New York, N. Y.
27. William L. May.....1897-1898....Detroit, Mich.
28. George F. Peabody....1898-1899....Omaha, Neb.
29. John W. Titcomb.....1899-1900....Niagara Falls, N. Y.
30. F. B. Dickerson.....1900-1901....Woods Hole, Mass.
31. E. E. Bryant.....1901-1902....Milwaukee, Wis.
32. George M. Bowers....1902-1903....Put-in Bay, Ohio.
33. Frank N. Clark.....1903-1904....Woods Hole, Mass.
34. Henry T. Root.....1904-1905....Atlantic City, N. J.
35. C. D. Joslyn.....1905-1906....White Sulphur Springs, W. Va.
36. E. A. Birge.....1906-1907....Grand Rapids, Mich.
37. Hugh M. Smith.....1907-1908....Erie, Pa.
38. Tarleton H. Bean.....1908-1909....Washington, D. C.
39. Seymour Bower.....1909-1910....Toledo, Ohio.
40. William E. Meehan....1910-1911....New York, N. Y.
41. S. F. Fullerton.....1911-1912....St. Louis, Mo.
42. Charles H. Townsend..1912-1913....Denver, Colo.

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*A special meeting was held at the Centennial Grounds, Philadelphia, Pa., October 6 and 7, 1876.

CERTIFICATE OF INCORPORATION OF THE AMERICAN FISHERIES SOCIETY

We, the undersigned, persons of full age and citizenship of the United States, and a majority being citizens of the District of Columbia, pursuant to and in conformity with sections 599 to 603, inclusive, of the Code of Law for the District of Columbia enacted March 3, 1901, as amended by the Acts approved January 31 and June 30, 1902, hereby associate ourselves together as a society or body corporate and certify in writing:

1. That the name of the Society is the AMERICAN FISHERIES SOCIETY.

2. That the term for which it is organized is nine hundred and ninety-nine years.

3. That its particular business and objects are to promote the cause of fish culture; to gather and diffuse information bearing upon its practical success, and upon all matters relating to the fisheries; to unite and encourage all interests of fish culture and the fisheries; and to treat all questions of a scientific and economic character regarding fish; with power:

a. To acquire, hold and convey real estate and other property, and to establish general and special funds.

b. To hold meetings.

c. To publish and distribute documents.

d. To conduct lectures.

e. To conduct, endow, or assist investigation in any department of fishery and fish-culture science.

f. To acquire and maintain a library.

g. And, in general, to transact any business pertinent to a learned society.

4. That the affairs, funds and property of the corporation shall be in general charge of a council, consisting of the officers and the executive committee, the number of whose members for the first year shall be seventeen, all of whom shall be chosen from among the members of the Society.

Witness our hands and seals this 16th day of December, 1910.

SEYMOUR BOWER	(Seal)
THEODORE GILL	(Seal)
WILLIAM E. MEEHAN	(Seal)
THEODORE S. PALMER	(Seal)
BERTRAND H. ROBERTS	(Seal)
HUGH M. SMITH	(Seal)
RICHARD SYLVESTER	(Seal)

Recorded April 15, 1911.

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PART I

BUSINESS SESSIONS

Transactions of the American Fisheries Society

Forty-second Annual Meeting, held at Denver, Colo., Tuesday, Wednesday and Thursday, September 3, 4 and 5, 1912.

Tuesday, September 3, 1912

Meeting called to order at 11.00 a.m. by the President, Mr. S. F. Fullerton, of St. Paul, Minn.

PRESIDENT'S ADDRESS

Gentlemen of the American Fisheries Society: I want to take this opportunity to personally thank you for the great honor you conferred on me at St. Louis last year. The honor is all the more appreciated, for the reason of my unaccountable absence at that time.

This Society, of which we are all so proud, is only in the infancy of its usefulness. The public is only beginning to realize the great benefit the artificial propagation of fish is to the state and also to the individual in the supply of cheaper food for his table, and in furnishing to the sportsman and lover of nature the recreation and pleasure derived from an outing on any of our lakes and streams.

If there were no fish in the waters, a large part of the pleasure of the outing would be gone. The different states are doing great work in making appropriations to carry on this splendid work. The United States Bureau of Fisheries, under the able management of the Hon. George

M. Bowers and his efficient assistants, is showing to the world what Americans can do in fish propagation. But, as I said in the beginning, the usefulness of this Society is only in its infancy. Great things must be accomplished by our fish doctors and scientists to combat the diseases that fish are heir to. But I have no doubt that this problem will be met and solved correctly.

As a nation we have been criminally wasteful of nearly all of our national resources. We have cut the timber from the headwaters of our streams and around our lakes, and what is the result? The disappearance of the water, and without the water we cannot have fish. We should begin to remedy the mistakes made and reforest around the headwaters of our streams and along our rivers, and in time get back much of that which has been lost.

It is a paying investment outside of the benefits derived in conserving our water supply. We have all seen bare hillsides where the timber has been cut away—and what looks more bleak and desolate? Also we are polluting many of the waters that we already have. There is not a man here present who does not know of some river or lake that has been made unfit for fish by pollution of some kind. It may be sewage or sawdust or some chemical from a tannery or packing plant, or some other of a dozen pollutions which some man or firm under the guise of commercialism—like religion, that word covers a multitude of sins—dumps into our lakes or rivers, not caring whether he destroys the fish in that lake or stream which belong to all the people in their sovereign capacity. But if you raise your voice in protest the cry goes up that you are interfering with business, that you will drive "Mr. Smith" to the rival city. Thus we lose the tannery if the owners are not allowed to do as they please.

Gentlemen, did you ever stop to think how we have been sitting idly by and letting things like this happen? It is our own fault. We have the remedy in our own hands, and if the American Fisheries Society will only start a cam-

paign against water pollution, we can soon make our influence felt. Get the greatest power for good in this country interested—I mean the press.

Two of the most beautiful cities in the United States have flowing through their midst the Father of Waters—the great Mississippi. This river has its source in my own state, and in the upper reaches its pure spring water is fit for any use. But in these two cities there are over three-quarters of a million inhabitants. Every sewer empties into this river, making it impossible as a home for any self-respecting fish, a place where no boy wants to go swimming, where there is no pleasure in boating, where the commercial few have spoiled the pleasures of this vast population, but if a voice is raised against the pollution they say that you are stopping the wheels of progress. But I predict that some day the people will rise up in their might and make the authorities stop this pollution, but that will be only when we get our cities to adopt the commission form of government, and the women of this country have the ballot.

Gentlemen, we are all sorry that the Hon. George M. Bowers, United States Commissioner of Fisheries, and many of the station superintendents have been deprived from meeting with us here today. I understand that, by a recent act of Congress, no financial provision is made for expenses of Government employees to attend meetings like the present gathering. We are all sorry that any law or any rule should have prevented these men from attending our meeting, and I want to say here and now that Congress has certainly blundered. Every man in charge of a Government fisheries station derives great benefit by attending our meetings; it is a schooling that does every one good. We get ideas from each other and we profit by them and so does the work of the Bureau. I would like to refer this matter to our Resolution Committee so that the proper action may be taken. We should urge the necessity of having a large representation of employees from the United

States Bureau of Fisheries at our meetings. The American Fisheries Society needs them and they need the help of the American Fisheries Society.

The president then introduced the Hon. Henry J. Arnold, Mayor of Denver, who made an address welcoming the society to the city. Dr. T. S. Palmer, of Washington, D. C., was called upon by the president to respond to the address of welcome.

PRESIDENT: The first order of business will be the roll-call of members. We are all sorry that Mr. Ward T. Bower, our Secretary, is absent in Alaska. However, Mr. Barton D. Evans, of Pennsylvania, has kindly consented to act as Secretary for this meeting.

REGISTERED ATTENDANCE

The registered attendance of members was 52, as follows:

COL. JOSEPH H. ACKLEN, Nashville, Tenn.
G. G. AINSWORTH, Leadville, Colo.
JABE ALFORD, Madison, Wis.
FRANK ANDERSON, Denver, Colo.
IGNATZ BALDUS, Indianapolis, Ind.
O. N. BALDWIN, Leadville, Colo.
D. C. BEAMAN, Denver, Colo.
RUDOLF BORCHERDT, Denver, Colo.
SEYMOUR BOWER, Detroit, Mich.
WILLIAM J. BRYAN, Lincoln, Neb.
NATHAN R. BULLER, Harrisburg, Pa.
EDWIN K. BURNHAM, Washington, D. C.
EUGENE CATTE, Langdon, Kan.
DR. R. E. COKER, Fairport, Iowa.
C. K. CRANSTON, Pendleton, Ore.
H. D. DEAN, Anaconda, Mont.
PROF. L. L. DYCHE, Pratt, Kan.
BARTON D. EVANS, Harrisburg, Pa.
WALLACE EVANS, Oak Park, Ill.
DANIEL B. FEARING, Newport, R. I.
DR. GEORGE W. FIELD, Sharon, Mass.
WILLIAM L. FINLEY, Portland, Ore.
RICHARD E. FOLLETT, Detroit, Mich.
SAMUEL F. FULLERTON, St. Paul, Minn.
GEORGE H. GARFIELD, Brockton, Mass.

H. D. GOODWIN, Milwaukee, Wis.
GEORGE H. GRAHAM, Springfield, Mass.
W. O. HART, New Orleans, La.
W. H. HUGHES, St. Louis, Mo.
W. J. HUNSAKER, Saginaw, Mich.
S. E. LAND, Denver, Colo.
DWIGHT LYDELL, Comstock Park, Mich.
C. C. MASON, Hermit, Colo.
WILLIAM L. MAY, Denver, Colo.
GEO. W. MILES, Indianapolis, Ind.
W. E. MUSGROVE, Leadville, Colo.
JAS. NEVIN, Madison, Wis.
W. J. O'BRIEN, Gretna, Neb.
DR. T. S. PALMER, Washington, D. C.
RICHARD PARTON, Paris, Mo.
DR. F. L. RISER, Henderson, Colo.
ERNEST SCHAEFFLE, San Francisco, Cal.
LEONARD W. SCHMAUSS, Leadville, Colo.
JAS. A. SHINN, Denver, Colo.
FRANKLIER SPENCER, JR., Provo, Utah.
G. H. THOMSON, Estes Park, Colo.
DR. CHARLES H. TOWNSEND, New York City.
C. H. VANATTA, Leadville, Colo.
PROF. H. B. WARD, Urbana, Ill.
J. QUINCY WARD, Frankfort, Ky.
R. TYSON WHITE, Brooklyn, N. Y.
C. W. WILLARD, Westerly, R. I.

THE FOLLOWING VISITORS ALSO ATTENDED

HENRY J. ARNOLD, Mayor of Denver.
S. B. COLLINS, Lost Lake Fish Hatchery, Creede, Colo.
H. H. HOLDAWAY, Salt Lake City, Utah.
O. E. JOHNSTON, Leadville, Colo.
SMITH RILEY, District Forester, Denver, Colo.

During the several sessions, the following regular committees were appointed by the President:

Programme: Mr. George H. Graham, Chairman, Massachusetts; Mr. George W. Miles, Indiana; Mr. Dwight Lydell, Michigan.

Nomination of Officers: Mr. Seymour Bower, Chairman, Michigan; Mr. J. Quincy Ward, Kentucky; Mr. Nathan R. Buller, Pennsylvania; Mr. G. H. Thomson, Colorado; Prof. L. L. Dyche, Kansas.

Time and Place of Meeting: Dr. George W. Field, Chairman, Massachusetts; Mr. George W. Miles, Indiana; Mr. Jabe Alford, Wisconsin.

Auditing: Dr. H. B. Ward, Chairman, Illinois; Mr. James Nevin, Wisconsin; Mr. Ernest Schaeffle, California.

Resolutions: Dr. H. B. Ward, Chairman, Illinois; Dr. Charles H. Townsend, New York; Mr. W. L. Finley, Oregon; Mr. W. J. Hunsaker, Michigan; Mr. D. B. Fearing, Rhode Island.

Publication: Dr. Hugh M. Smith, Chairman; Dr. T. S. Palmer; Mr. Ward T. Bower, all of Washington, D. C.

Col. Joseph H. Acklen, President of the National Game Wardens' Association, and Chief Warden of the Department of Game, Fish and Forestry, Nashville, Tenn., then addressed the Society upon "Water Pollution and Other Notes."

PRESIDENT: We shall be glad to hear from Mr. Fearing, of Rhode Island, on the matter of indexing the Transactions of the Society.

MR. DANIEL B. FEARING, Rhode Island: A couple of years ago I volunteered to have an index of the publications of the Society made, and the task was started; but my librarian, who has been doing the work very cheerfully, has informed me that she is going to get married, and has left me. The work will be done, however, and I simply wish to report progress, and that the index will be ready for printing soon.

PRESIDENT: We are greatly indebted to Mr. Fearing for his work.

Through the courtesy of Mr. Wallace Evans, ornithologist, of Oak Park, Ill., and Mr. Richard E. Follett, of the Detroit Zoological Society, Detroit, Mich., the Society was treated to a very interesting and instructive exhibition of colored motion pictures of various wild birds, also of salmon fishing in the north and of the tuna fishing of Italy.

A visit was then made, by means of automobiles furnished by Denver representatives, to the State Fish Hatchery near Denver.

The President called the meeting to order at 3 o'clock p.m., same day, at the Albany Hotel.

PRESIDENT: The first paper will be by Mr. George W. Miles, of Indiana, on "A Defense of the Humble Dogfish."

Mr. Miles then read his paper, which was discussed.

Letters were then read by Mr. Graham from the Hon. George M. Bowers, United States Commissioner of Fisheries, Washington, D. C., from Dr. P. P. C. Hoek, Scientific Fishery Adviser of the Dutch Government, Haarlem, Holland, and from the Hon. W. L. Calderwood, Inspector of Salmon Fisheries for Scotland, Edinburgh, Scotland. These gentlemen wished a successful meeting, and expressed regrets at not being present. In addition, Mr. Calderwood stated that a paper he had prepared for the Society quite a number of years ago had not been published, nor was it returned. He expressed the feeling that he had not received as considerate treatment at the hands of the Society as was due.

MR. FEARING: The gentleman who wrote that letter is an old correspondent of mine. He stands as the highest authority in England today on the salmon; his book entitled "Salmon," published last year, is the final word in respect to that fish. It pains me extremely to consider that a man of his standing and knowledge should have felt as he does. Mr. Calderwood is the man of all others who should be made an honorary member of this Society; and it seems to me that the fullest recompense we can make to him is to elect him an honorary member of this Society. I move that he be so elected.

PROF. H. B. WARD, Urbana, Ill.: I second Mr. Fearing's motion. It is undoubtedly true that the trouble was in some way due to the difficulties of international mail service; and the Secretary can write Mr. Calderwood to that effect.

There is no question about his very high standing in the scientific world, and especially in the field of fish culture.

Mr. Calderwood was unanimously elected an honorary member.

PRESIDENT: The people of Denver have been very kind to us and have provided some entertainment for us in the way of a banquet Thursday night. In addition, Mr. G. W. Pell, who deals in fish and oysters and has an extensive business here, has tendered to the members of the American Fisheries Society a banquet on any night that we may choose. The invitation was unanimously accepted for Wednesday evening at 9.30.

MR. WILLARD: I move the election of the following applicants for membership:

NEW MEMBERS

The following 73 persons were elected to membership:

ANDERSON, FRANK, 1331 East Seventh Ave., Denver, Colo.
ANTOINE, CHARLES, 340 South Wabash Ave., Chicago, Ill.
BABCOCK, WILLIAM H., 520 The Rookery, Chicago, Ill.
BAILEY, HOWARD S., Equitable Building, Denver, Colo.
BARNES, ERNEST W., Supt. R. I. Fisheries Experiment Station, Wickford, R. I. (Life.)
BAUER, A., Twenty-fifth and Dearborn Sts., Chicago, Ill.
BELLOWS, I. H., 732 Fullerton Ave., Chicago, Ill.
BONFILS, FREDERICK G., *The Denver Post*, Denver, Colo.
BRYAN, WILLIAM JENNINGS, Lincoln, Neb.
BULLER, G. W., Pleasant Mount, Pa.
BURKE, THOMAS F., Colorado Fish and Game Commission, Denver, Colo.
CALDERWOOD, W. L., Inspector of Salmon Fisheries for Scotland, Edinburgh, Scotland. (Honorary.)
CAMPBELL, WALTER E., Altamosa, Colo.
CAPELL, ARCH. T. P., U. S. Bureau of Fisheries, Leadville, Colo.
CARTER, E. A., Springfield, Mass.
CLEVELAND, DR. GEORGE HENRY, 1909 Ogden Ave., Chicago, Ill. (Resigned.)
CLIFFORD, CHARLES P., First National Bank, Chicago, Ill.
DANGLADE, ERNEST, U. S. Bureau of Fisheries, Washington, D. C.
DEBACA, TRINIDAD C., State Fish and Game Warden, Santa Fe, N. Mex.
DILG, WILL. H., Hearst Building, Chicago, Ill.

ELLIOTT, CHARLES C., 851 Center St., Elgin, Ill.
ENGELBRECHT, P. J., Thomasville, Colo.
FEARING, MRS. D. B., Newport, R. I. (Life.)
FINLEY, W. L., 806 Yeon Building, Portland, Ore.
FLETCHER, EMERY L., Ely, Nev.
FOOT, FRANCIS D., 42 Florentine Gardens, Springfield, Mass.
FORTMANN, HENRY F., 1007 Gough St., San Francisco, Cal. (Life.)
FOUND, WM. A., Department of Marine and Fisheries, Ottawa, Canada.
FRENZEL, A. B., 1540 Sherman Ave., Denver, Colo.
GILSON, ARTHUR, 124 South Main St., Memphis, Tenn.
HALL, JOHN D., U. S. Bureau of Fisheries, Duckabush, Wash.
HAVILAND, JAMES W., Colorado Fish and Game Commissioner, Denver, Colo.
HAYFORD, CHARLES O., Supt. State Fish Hatchery, Hackettstown, N. J.
HEIM, L. C., Marine, Ill.
HESTON, N. C., 6936 South Park Ave., Chicago, Ill. (Resigned.)
HOSSELKUS, BERT. C., Creede, Colo.
HUMMEL, WILLIAM P., Colorado Fish and Game Commissioner, Denver, Colo.
HUNSAKER, W. J., Board of State Fish Commissioners, Saginaw, Mich.
HUSTED, JAMES D., Denver, Colo.
INK, CHARLES, 434 East Market St., Akron, Ohio.
JOHNSON, J. G., Comstock Park, Mich.
JONES, LOMBARD C., Falmouth, Mass.
KEMMERICH, JOSEPH, U. S. Bureau of Fisheries, Washington, D. C.
LEAVITT, PERCY W., P. O. Box 374, Akron, Ohio.
LOESCH, H. C., Colorado Springs, Colo.
MALONE, EUGENE, State Fish Hatchery, Henderson, Colo.
MASON, C. C., Hermit, Colo.
MERRILL, BERTRAM G., Illinois Fish Conservation Society, Hinsdale, Ill.
MUSGROVE, W. E., Leadville, Colo.
NEWCOMB, WILLIAM, Tenafly, N. J.
NEWKIRK, HAWLEY A., 7 West Madison St., Chicago, Ill.
ONDERDONK, CHARLES S., 811 Ideal Building, Denver, Colo.
OTIS, SPENCER, Railway Exchange, Chicago, Ill.
PALMER, MARSHALL G., 96 East Ave., Kankakee, Ill.
PIERCE, HENRY L., Colorado Fish and Game Commission, Denver, Colo.
POTEET, L. A., Deputy Warden, Florence, Colo.
REEME, E. W., Leadville, Colo.
REYNOLDS, B. B., Water Superintendent, Colorado Springs, Colo.
RIBBING, CHARLES A., Hazeltine, Colo.
RISER, DR. F. L., Henderson, Colo.
ROE, S. S., Colorado Fish and Game Commission, Denver, Colo.
SCHAEFFLE, ERNEST, Secretary California Fish and Game Commission, San Francisco, Cal.
SHOPE, S. P., 941 Lawrence Ave., Chicago, Ill.

SPARGUR, ROBERT L., Chief Clerk Colorado Fish and Game Commission, Denver, Colo.
SPENCER, F., Provo, Utah.
SPERRY, E. P., 126 South Euclid Ave., Oak Park, Ill.
STIVERS, D. GAY, Butte Anglers Association, Butte, Mont.
TOWNSEND, DR. CHARLES H., Director New York Aquarium, New York, N. Y. (Life.)
VOGT, JAMES H., Nevada Fish Commission, Carson City, Nev.
WARD, J. QUINCY, Executive Agent, Kentucky Game and Fish Commission, Frankfort, Ky.
WEBER, E. D., P. O. Box 81, Littleton, Colo.
WEHLE, O. C., 5471 Kimbark Ave., Chicago, Ill.
WENTWORTH, NATHANIEL, Fish and Game Commissioner, Hudson, N. H.

PRESIDENT: We have applications from two different places with regard to the place of our next meeting, one from Indianapolis and one from Boston.

There is a matter I would like to bring before the Society in connection with the time and place of meeting, and I would like to have the members of the committee consider it if they will. We have just had a meeting here in Denver of the National Game Wardens' Association. Many of us who are members of that organization belong to the American Fisheries Society. Our work overlaps; one protects and the other propagates. I think it would be a good thing to get the views of some of the members of the National Game Wardens' Association as to their time and place of meeting. They are willing to meet two or three days before or after our meeting. I want to bring this to the attention of the committee.

A paper on the "Protection of Undersized Fish," including exhibits of specimens, was read by Mr. G. H. Thomson. The paper was discussed.

The Secretary's report was then read by the Secretary pro tem, accepted, and placed on file.

REPORT OF THE RECORDING SECRETARY

To the Officers and Members of the American Fisheries Society:

The major part of the Secretary's work since the last meeting of the Society has been the publications of the Transactions. It may have seemed to members that the interval of several months following the St. Louis meeting before the appearance of the volume was unduly long, but it is to be remembered that the editing and arranging of material amounting to 350 printed pages is no slight task. The proof reading and correspondence with authors, not to mention unforeseen delays in the printing, add to the Secretary's duties and still further postpone the issue of the Transactions.

The volume for 1911 contains 22 papers, with 3 illustrations, and the usual business proceedings, the list of members, and other standing or routine matter. Competitive bids for the printing were solicited, and the contract was let to the W. F. Roberts Company, of Washington, D. C. The cost of publishing the edition of 750 copies was $908.21. Dr. H. M. Smith, as chairman of the Publication Committee, was in general charge of the work, which was attended to directly by the Secretary and Assistant Secretary, who are the other two members of the Committee.

It will be recalled that the 1910 report was subject to some criticism for certain blank pages which were considered by some of the members to be unnecessary. It seemed to be agreed, however, that the issue of papers separately was desirable, in certain cases, at all events. To arrange for this it is necessary to have each paper begin on a new odd page, and some blank pages inevitably result. There are a total of 14 such blank pages in the 1911 report, but the printer made a reduced rate on them.

Sales of reports during the year have amounted to $37.70. The Fortieth Anniversary volume (1910) has been sold at $2.00 per copy, the other issues at $1.00, as decided upon by the Society at the St. Louis meeting. Sales would have been larger but for the scarcity of many issues. Several inquiries have come from libraries which desired to obtain a full set of the Transactions.

The number of reports now in the hands of the Secretary, by years, is as follows:

1876	1	1902	6
1888	1	1903	2
1894	1	1904	67
1895	2	1905	2
1896	2	1906	103
1897	2	1907	97
1898	2	1908	122
1899	3	1909	101
1900	4	1910	119
1901	4	1911	89

Deaths of the following members have been reported since the last meeting:

JOHN L. LEARY, San Marcos, Texas. Joined the Society in 1901. Died December 23, 1911.
J. F. ROEPPLE, Fairport, Iowa. Joined 1910. Died January 30, 1912.
JOHN F. HILL, Bangor, Me. Joined 1911. Died March 16, 1912.

The following members have resigned during the past year:
S. ZWIEGHAFT (1892), Philadelphia, Pa. October 21, 1911.
EDWARD I. FROST (1910), Asheville, N. C. October 21, 1911.
JOHN S. SCULLY (1908), Washington, D. C. October 21, 1911.
H. G. THOMAS (1902), Stowe, Vt. October 24, 1911.
JOHN G. RUGE (1898), Apalachicola, Fla. October 25, 1911.
F. W. AYER (1892), Bangor, Me. November 15, 1911.
JOHN M. CRAMPTON (1907), New Haven, Conn. November 18, 1911.
C. W. DORR (1908), Seattle, Wash. December 8, 1911.

Owing to the unusual expense of publishing the Anniversary volume of the Transactions in 1910, a deficit of several hundred dollars faces the Society, and means of raising funds must be considered. Dr. Charles H. Townsend suggests the plan of taking out life memberships, and has taken the lead by sending his own check for this purpose. This plan is commended to the attention of all the members.

By way of suggestion, the attention of the Society is invited to one of its articles of incorporation—namely, that empowering it "to conduct, endow or assist investigation in any department of fishery and fish-culture science." If the present indebtedness be regarded as a hindrance to action of this kind at the present time, the matter may well be kept in mind for the coming year.

During the absence of the Secretary, who has been in Alaska since June, his duties have been discharged by the Assistant Secretary.

Respectfully submitted,

WARD T. BOWER,
Recording Secretary.

JUNEAU, ALASKA, August 8, 1912.

The Treasurer's report was then read and referred to the Auditing Committee.

REPORT OF THE TREASURER

To the American Fisheries Society:

I herewith present my annual report as Treasurer from October 3, 1911, to September 3, 1912:

RECEIPTS.

1911				
		Sale of Reports	$ 37.70	
		Yearly dues	859.00	
		Life membership fees	75.00	
				$971.70

EXPENDITURES.

Oct.	5.	Balance due Treasurer	$563.65	
"	5.	Sundry expenses, St. Louis meeting	1.25	
"	12.	W. H. Gill, lettering certificates	50.00	
"	12.	Ward T. Bower, Sec'ty, sundries	6.60	
"	16.	C. J. Butler, envelopes	10.72	
Nov.	13.	Stamped envelopes	10.72	
"	24.	W. H. Gill, lettering certificates	20.40	
1912				
Jan.	2.	W. F. Roberts Co., by Sec'ty	61.38	
"	2.	Goodwin & McDermott, stenographers	180.00	
Feb.	5.	W. F. Roberts Co. by Sec'ty	7.00	
June	17.	Ward T. Bower, Sec'ty, postage, etc	19.30	
"	27.	W. F. Roberts Co. by Sec'ty	7.75	
"	29.	J. T. Murphy, printing	4.00	
July	15.	Stamped envelopes	10.68	
Aug.	2.	Ethel M. Smith, Ass't Sec'ty, stamps, etc	13.99	
"	7.	Account books and postage	2.00	
"	17.	J. C. Hall Co., receipt books	6.75	
"	29.	Clerical services, various dates	3.50	
		Balance due Treasurer		$ 7.99
				$979.69

Accounts due and payable, W. F. Roberts Co.	$909.56
Total indebtedness	917.55

Respectfully submitted,

C. W. WILLARD, *Treasurer.*

WESTERLY, R. I., August 29, 1912.

MR. GEORGE H. GRAHAM, Springfield, Mass.: I would like to ask the Treasurer how many members are in arrears for dues?

TREASURER: I cannot state the exact number, but I think 250. During the past year I have made an earnest effort to collect all the dues possible. To do this I have written at least 150 or 200 personal letters. These letters have brought about all the money that I think we can expect to get from the delinquent list. I do not see how any one that ever expected to pay could fail to respond to the appeals that I sent out. Therefore it would seem to me as if we must either increase the dues or raise a fund in some way to wipe out the present indebtedness.

PRESIDENT: It is a problem the Society will have to take up before the meeting is over.

SUGGESTIONS FOR INCREASING MEMBERSHIP

The Secretary *pro tem* then read a communication from Mr. H. Wheeler Perce, of Chicago, offering suggestions for the enlargement in scope and membership of the Society, as follows:

CHICAGO, ILL., August 27, 1912.

Mr. Samuel F. Fullerton, Pres't,
American Fisheries Society,
St. Paul, Minn.

DEAR SIR:

At the last meeting I gathered that an increased membership was something considered very desirable, and through the year I have not only done my best to secure desirable new members, but have given the question very much thought, and it appears to me wise to suggest to the forthcoming meeting the results.

To the casual or even the interested observer it might seem that the wonderful work of the American Fisheries Society, incalculable in value to the people of this country, does not reach as many of the people as it should, and thus convey to them the educational advantages which the Society produces. It might therefore be advisable to enlarge the membership of the Society and spread abroad its teachings and findings to a greater degree than heretofore.

To this end, let me respectfully suggest that state or district chapters of the Society be formed within its membership, with a state or district chairman presiding over same, and thus permit of more frequent meetings of at least certain groups, which could meet quarterly or, possibly, monthly and thus maintain a continued interest in the various subjects and each year produce a more extended contribution to the annual meeting. In this way local conditions would be more closely studied and reported to the central body and a wider grasp of all situations maintained.

I am moved to this suggestion in view of the great success attending this form of organization in so far as it relates to the American Institute of Architects. For some years I was closely allied with the Illinois chapter of the American Institute of Architects and had occasion to note how well, and with what splendid results, the plan worked. Monthly meetings were held by nearly all the state chapters and a high tension interest in the work was maintained at all times. As a result, the parent body was much benefited, all the great questions of architecture were thoroughly promulgated, and the art was kept on a constantly progressing basis. Much of the great twentieth century architectural beauty of today is directly traceable to the influences exerted by the organization referred to and through its form of organization.

In addition to this, it seems to me that it would be of great value if the American Fisheries Society could maintain a magazine, through which a widespread membership and interest could be promoted in a manner similar to the plan of the National Geographic Society, the success of which, I understand, is more than gratifying, not only from a financial standpoint, but as a means of spreading geographical information.

A magazine devoted to the subjects covered by the American Fisheries Society could undoubtedly be made just as attractive as the "National Geographic Magazine" to the thousands of readers, who would thereby become more fully acquainted with the conditions attaching to fish and fishing. This, I am sure, can be said without fear of contradiction in regard to the vast number of anglers in the United States, who would become ardent adherents of the American Fisheries Society and form one of its strongest supporting branches. It can be said truly of many who engage in sport fishing that they can be educated to a higher degree as to the conservation of fish—not only from a sport standpoint, but from a commercial standpoint—and, thus properly educated, no body of men would be more earnest in supporting good measures.

It can be truthfully said that practically no journal published today treats of fish and fishing in a strictly modern educational manner. The journals are either dominated by the advertising department or run to such an extreme degree of fiction that but little reliance can be placed in what they say. Again, part of them are dominated by some single pet scheme of reform, to the exclusion of some other pet

scheme of reform attaching to competing publications, and thus there is no unity of assault upon objectionable practices in connection with fish and fishing, nor any unity in promoting those reforms leading to conditions which those of us who have the entire matter at heart so much desire.

It seems to me almost a certainty that a magazine gotten up with plenty of pictures and plenty of good, solid facts, told in a popular manner, with no domination from the advertising department or no personal "axe to grind," and containing within its covers each month something of vital importance in relation to the subjects listed in the five objects of the American Fisheries Society, would prove a "winner" from the very start and be of tremendous educational value.

I have covered these two suggestions in but a feeble manner, but among the members much in addition will undoubtedly suggest itself, and I simply respectfully submit these suggestions in the hope that they may receive the kindly consideration of the members of the Society, and I am moved so to do solely through a strong and earnest desire to see this greatest and, I believe, oldest conservation society still further increase the efficiency and scope of the wonderful work it has done and is doing through the splendid minds that have unselfishly given of their best to the cause.

Respectfully submitted,

H. WHEELER PERCE.

PRESIDENT: This communication is from one of our most active members, and I should like to hear some discussion on it. Mr. Perce has been very active in getting new members.

MR. G. H. THOMSON, Estes Park, Colo.: It seems to me we should take action on the recommendations and suggestions upon the educational line. It has been suggested that this is one of the vital features of the American Fisheries Society. I believe the time is coming when this matter of education along these lines is going to be taken up in our public schools, and there is where it ought to be taken up.

I should like to see a committee appointed to carry out the suggestions of the paper, especially the suggestion of printed matter to circulate in public schools and generally.

MR. GEORGE H. GRAHAM, Springfield, Mass.: I think we must consider the advisability of raising the dues. When the dues were first placed at $2, the reports that were issued

were nothing as compared with what the reports are today; and every man that has received the report for the last two years has surely received more than two dollars' worth. No society can give out more than it receives and still have a surplus in the treasury. The report for 1910 cost between $1200 and $1400. Now, if we are taking in $800 in dues and paying out $1200 for reports, where is the rest of the money coming from? I do not think there is a member who would object to paying $3 a year to get this report.

MR. C. K. CRANSTON, Pendleton, Ore.: $3 would not do the business, would it?

MR. ERNEST SCHAEFFLE, San Francisco: There is a balance due now of $970. We must not only meet that, but pay additional running expenses.

MR. GRAHAM: We must have a large membership in order to do it, but even with an increased membership we must make the dues $3; we must consider that such an increase would be cheerfully met.

MR. CRANSTON: I am new in this business. I have only been a member for three years, and this is my first attendance at the meetings; but I have read the copies of the Transactions that have reached me, with a good deal of interest; and I feel perhaps more deeply than I can express the importance of the perpetuation of this Society. It strikes me that a well-planned method to increase the membership might be of advantage. I do not know how well that has been worked out or how thoroughly it has been tried; but perhaps the method I am going to suggest will lead to the betterment of our financial condition. My suggestion is that all persons here should obligate themselves to bring in new members. I feel confident that with the increased dues suggested I can obligate myself to bring in three or four new members. If others are as much interested as I—and I have no doubt many if not all here are—the problem will be solved.

PRESIDENT: I think this matter ought to be taken up in committee and thoroughly discussed, to determine whether it is best to raise the membership fees; or whether it is best to make an appeal to every member here present to secure at least two new members. I started out to get 50 last year, but I got only 12 new members; but if every member would secure two new names, it would solve the problem. There is merit also in the suggestion of raising the dues. The report we get is well worth a great deal more than that, as the gentleman stated.

MR. THOMSON: Has the American Fisheries Society a committee on education?

MR. GRAHAM: A committee on publicity was appointed at St. Louis last year. Mr. Meehan made himself chairman, but I do not think he has done anything about it. There has been practically nothing done, except what some of the other members of the committee did themselves, and that has not amounted to very much. I believe that a permanent committee on membership and publicity should be appointed, and I believe that committee should be required to make a report at every meeting.

PRESIDENT: I think the suggestion is a good one; we cannot have too much publicity. The newspapers would be glad to give us space if we would give them something to write about. I shall be glad to appoint the committee.

MR. GRAHAM: Would it not be well to consider this matter when there is a larger attendance? I would like to drop it until tomorrow.

Adjournment then taken until 9.30 next morning.

Wednesday, September 4, 1912, 10.00 a.m.

Meeting called to order at the same place by the President.

A paper on "Black-spotted Mountain Trout," by Mr. S. E. Land, of Colorado, was then read and discussed.

Dr. Palmer then read a paper by Mr. C. H. Wilson, of New York, on "The Whitefish—Minimum Size Limits—The Scales vs. The Yard Stick."

REPORT OF EXECUTIVE COMMITTEE

PRESIDENT: We will now receive the report of the Executive Committee, of which Prof. H. B. Ward is chairman.

PROFESSOR WARD: Mr. President and Members of the Society: The Executive Committee appointed last year has made a serious effort to consider some of the problems before the Society. A meeting was held at the close of the session in St. Louis, and correspondence has been carried on so far as possible in the interval between that meeting and this. Some conclusions were then reached which it seems to me are worth your consideration and such action as may be deemed wise.

I might state informally that the report has not been presented to and signed by every member of the committee, but is made up of extracts from the correspondence. I had hoped that a majority of the committee would be present, but the members are scattered pretty widely. I believe the statements that I give will command the support of every member of the committee. I have omitted from this report statements which seem to be matters of discussion, and therefore questionable as a full report from the committee.

The committee would recommend that the Society offer to the libraries of the United States the option of taking out regular and continued subscriptions to the publications of this Society, on a basis of an annual payment of $1.50.

It would further recommend that all such libraries as engage to take our series of publications as issued be entitled to secure the copies of back publications still in the hands of the Secretary, at an expense of $1 each, provided five volumes be purchased at one time.

I might say by way of explanation that at the price of $1.50 we give the library a slight advantage over what one

might call the outside membership price of $2 a year. At the same time we place those publications where they will be of great value to us in the way of advertisement, and also of value to the persons of all types who are interested in the study of fishery matters and in the reading of the papers which are presented before the organization.

It will be noticed, but it ought to be called definitely to your attention, that the offer to sell volumes at $1 each to a slight extent contradicts the ruling of the Society that the anniversary volume, which you remember was such a splendid thing, be not sold for less than $2; but if libraries will agree to take 5 copies, it seemed worth while to bait the hook a little for them, by giving them that fine anniversary volume at the regular price.

From the report of the Secretary we have, it appears, over 100 copies of 5 or 6 years of our later volumes, and 30 to 70 copies of a few others. They are now costing the Society storage, and they might be doing good missionary work. I happen to know from correspondence with libraries and from conversation with librarians, that as a rule the larger libraries of the country are ready to enter into subscription engagements with societies to take a series of publications like yours, which of course is the great national society and the only society representing this interest in the country.

The Executive Committee would further recommend that publications be not sent to members who are in arrears of dues, but that a communication be sent to such, indicating the willingness of the officers to supply the publication as soon as the arrearage is made good. I believe some members of the Society would be astonished to see to what extent we have sent our publications to those who have not reasonably—I believe I may say—considered their obligations. Some persons who have paid $2 or $4 have received publications costing the Society $10 or $12; and it is perhaps doubtful whether the Society ever gets the arrearage from

those whose interest in the subject or in the organization at least seems to have declined.

The Executive Committee further recommends that a communication be sent by the new Executive Committee to all members in arrears, calling their attention to the fact that the Society is at present in need of the dues which they owe to the organization, and that it has come into its present condition by virtue of having printed and sent them valuable publications.

Many of these members have permitted their dues to remain unpaid through carelessness. In calling their attention in this fashion to the present needs of the Society, it may be hoped that some portion of the deficit which the Society has incurred may be made good in that way.

PRESIDENT: I am sure the Society will be pleased with this report which represents such careful consideration.

MR. THOMSON: I move the adoption of the report.

Motion seconded.

DR. T. S. PALMER, Washington, D. C.: May I ask Professor Ward whether the Executive Committee is prepared to furnish complete sets of the back volumes of the Transactions?

PROFESSOR WARD: Unfortunately not. The series is a very long one and the earlier volumes are entirely inaccessible. I believe Mr. Fearing is the only one who has a complete set.

MR. FEARING: Unfortunately I have not a complete set. The only complete set is in the library of the United States Bureau of Fisheries.

DR. PALMER: I had an experience with two different technical publications of this character. In one case we had a series of some twenty-odd volumes which there was no general demand for aside from a few specialists. In the other case we had a series of twenty-five or twenty-six volumes for which there was a more general demand. Of the larger series we prepared a very comprehensive index at con-

siderable expense, somewhat to the consternation of our members who thought we were spending too much money on this index; but it immediately made available and made live capital of all the back dead stock, and with this index in the hands of libraries they immediately began to ask for a complete set. It was impossible to furnish complete sets, but we furnished sets lacking one or two volumes, of the other series, which was still more technical.

The Executive Committee was hard pressed for funds and tried the expedient of securing more members and contributions, but we found that the back volumes of the Society were after all very important capital. They went over the series with great care, fixed a separate price on every individual volume according to the stock on hand, made a figure for complete sets, or as near complete sets as they could furnish, then recommended a figure a little below the current figure for the common volume.

If I understand the committee, they are prepared to furnish back volumes at $1 each if five or more are taken. But the volumes are unequal in value, and I believe much more would be gained by setting a definite price on the last 10 or 15 volumes, and on certain volumes needed to complete sets; and after this index is in the hands of libraries, there will be a general call for certain volumes, or as complete sets as we can furnish; and if the index is issued promptly and is on the market on or before the time of this announcement, it will be possible to realize considerable income from the back volumes, if they are husbanded. If any of the members who have odd numbers will turn them over to the Society, there will be a very substantial sale for them.

The price of the publication I speak of is $3; we cut it to $1.50, and sold a number of sets at $75 each, because libraries wanted complete sets; and the index shows them that they must have the back numbers.

MR. FEARING: The index that I am having prepared ought to be ready for the printer on December 1st. I think

it would be a very good thing for the Society if reprints were made of the lacking volumes, omitting all extraneous matter bound in the earlier volumes, and simply reprinting the papers found in each index.

DR. CHARLES H. TOWNSEND, New York City: Most of the early numbers are very thin pamphlets. I think the suggestion of reprinting is a very good one. They could probably be printed in a single volume at small expense.

MR. FEARING: For 26 years I have been trying to complete my set, and I was prepared to pay up to $25 for a single copy of the first volume. I know of only two copies of that issue; one is in the New York Public Library, which was part of Mr. Fred Mather's set, and the other in the hands of the United States Bureau of Fisheries. Mr. Livingston Stone's wife has written me that she thinks that somewhere Mr. Stone has a complete set, but they have not so far been able to find it. My own set is complete aside from the first volume.

MR. EVANS: I see by the Secretary's report that the 1910 proceedings cost $1200 for 700 copies. Is it right to sell them for $1?

DR. WARD: I called attention to the fact that the rules of the Society provide that the 1910 issue is to be sold at $2, and that other copies are to be sold at $1. At the same time the committee felt, as it could offer no complete sets whatever, nor anything like a complete set, that it was necessary to bait the hook which was dropped into the library pool with a pretty delicate morsel—in other words, an opportunity of getting a $2 book for $1. I have here a list of the copies available. There are only 19 of the 50 volumes which can be had at all; one copy of 3; three of 5; five or six copies of 4 volumes; and then of six volumes there are 70 to 125. Practically, in other words, there are only 8 volumes that could be supplied to any extent—from 1904 to the present day. The other volumes are in the hands of the

Society in such small numbers that they play practically no part in the problem.

DR. PALMER: I will offer the following amendment to the report:

1. That in lieu of the suggestion of the committee that 5 volumes be sold at $1 apiece, the committee be authorized to fix the price of individual volumes according to their scarcity.
2. That the committee be authorized to ascertain and report to the Society the probable cost of reprinting the earlier scarce volumes.
3. That the committee be authorized to obtain by purchase any of the latter numbers which may be needed or specially desirable.
4. That the committee be authorized to report to the Society a method of financing the publication of the index at an early date, because indexes are very expensive publications, costing more than twice that of ordinary matter.

In the case of the index I spoke of it was necessary for certain members to underwrite the project to the extent of a considerable sum, with the idea that later they would be repaid. This was done in order to insure early publication of the index. Indexing is usually one and one-half or double-priced matter; and it will cost something to get this index out.

Amendment seconded and unanimously carried.

DR. WARD: I believe a motion is still pending on the report of the Executive Committee. We have just had an amendment to that motion. Was the reference to the Executive Committee, as I understood, or was it possibly to the Publication Committee?

DR. PALMER: My amendment was to the report of the Executive Committee.

PRESIDENT: It is moved that the committee's report as amended be adopted.

Seconded and unanimously carried.

The Auditing Committee then presented a report on the Treasurer's account as follows:

This account, with vouchers accompanying, has been carefully examined and the same found correct.

Signed: HENRY B. WARD,
JAMES NEVIN,
ERNEST SCHAEFFLE,
Auditing Committee.

The report of the Auditing Committee was adopted.

Recess taken until 2 o'clock p.m.

Meeting called to order by the President at 2.30 p.m.

IRRIGATION DITCH SCREENS

MR. G. H. THOMSON, Estes Park, Colo.: I would like to have a committee of three appointed to investigate the merits of two forms of screens to prevent the loss of fish in irrigation ditches. If the Society can recommend the most desirable form, we can bring it before our legislature next winter in an attempt to secure an appropriation to protect our streams.

MR. S. E. LAND, Denver, Colo.: The screens are on exhibition out at Washington Park in readiness for inspection. I am in favor of a committee to examine them and report back to this body as to their use at the heads of our irrigation ditches.

I would not like to recommend anything that will place any great burden on the Society with reference to deciding upon which is the best screen; but if we see fit, let us resolve that we are in favor of some practical device that can eliminate or prevent the fish from going down the irrigating ditches and being destroyed. We can then take up the matter before the legislature and say that it is worthy of their consideration.

Now, if we can go before the legislature and say that a certain screen, according to the views of the American Fisheries Society, is practical, we can with fair prospects of success ask the legislature to appropriate enough money to buy a few and give them a thorough trial as to their practical

value; also to see if the farmers will be willing to accept them. If it is a good thing we want it, but if it is not going to be accepted by the agricultural interests of this state or any other state like California, Idaho or Utah, then it will be a hard proposition, and we will not accomplish anything.

MR. SCHAEFFLE: We are very greatly interested in California in the screening of ditches, but I believe it would be unwise for any society such as this to recommend one screen or any one device to the exclusion of any other device. I think it is a matter of bad policy and very unsafe.

MR. FRANKLIN SPENCER, JR., Provo, Utah: I am interested financially in both of these screens, but I do not come to this meeting with any intention of having either screen recommended above the other. The question is, do the states that have irrigation want their streams screened so as not to obstruct the flow of water to the farmer, and at the same time keep the fish in the channels where they belong? I think it should be the concensus of opinion of this committee, if it is appointed, to recommend the use of a screen that will give the irrigator his water without obstructing the stream, and keep the fish in their proper channels. I believe either of the screens will do that.

Mr. Thomson moved that a committee of three be appointed to examine the screens on exhibition and report the style deemed best. Seconded by Mr. Spencer.

The vote was taken and apparently carried.

MR. EVANS: I call for a division.

MR. SCHAEFFLE: Is not the Society on record as being in favor of the installation of screens everywhere, where practical screens can be installed?

PRESIDENT: The Society is in favor of it, but when a motion is made and seconded the chair must put it.

Division was taken and the President declared the motion to be lost.

PRESIDENT: We have with us a gentleman we would like very much to hear from—Judge Beaman, of Denver, a man

most of you know, if not personally, at least by reputation. He is one of the greatest fishermen in the west, a man who has fished longer than any one that I know of.

Judge Beaman then addressed the Society, pointing out particularly the fact that the automobile has become a very important factor in the depletion of fish and game.

The automobile is the friend of the hunter and the fisherman, but the worst enemy that ever came into the country of the game and the fish, and I have had considerable experience and observation as to that this year. I returned a few days ago from a 400-mile automobile trip. I fished in the Big Laramie, the North Platte and several of their tributaries in Colorado and Wyoming. It was a trip I never would have made without an automobile; I could not have made it by team, as it would have taken a month. I found on these big streams, wherever we stopped to fish, two or three automobiles with fishermen and hunters near us. With an auto a man can leave Denver in the morning and go 20 or 30 miles into the country, and have two or three hours' fishing and return the same day. If he goes up to one of our summer resorts, instead of having to fish within a mile or two of where he stops, he will with his automobile run up 20 miles in the morning to a tributary and come back at night. A man who made an automobile trip last week told me he had killed 60 sage chickens without leaving his automobile. That is, he shot from the road; he did not hunt at all; he had no dog.

While we were in Wyoming we met some Cheyenne men in an auto. They had strung across the front of their machine a big lot of fish. We passed on a couple of miles and found a sack of sage chickens which they had lost. We had them for supper.

I tell you that the auto is going to deplete our game and fish faster than anything we have ever had. I believe it is going to cause a depletion of fifty per cent or more in the next two years. But I do not know how you are going to avoid it.

Mr. Lydell informed the Society that Mr. Wm. P. Morton, of Providence, R. I., one of the oldest members, was ill at his hotel and unable to attend the meetings. Flowers were sent to Mr. Morton as a token of regard and of sympathy for his illness.

A paper on "Fishways," by Mr. W. O. Buck, of Neosho, Mo., was then read by the Acting Secretary and discussed.

At the request of Col. James A. Shinn, the President appointed a committee to arrange the toasts and programme for the banquet occurring the following evening. Dr. Ward, Dr. Palmer and Mr. Fearing were named on the committee.

A paper on "The Work of the Oregon Commission" was read by Mr. C. K. Cranston, of Pendleton, Ore. Discussion followed.

Recess taken until 8 o'clock p.m. same day.

Meeting called to order by the President at 8.15 p.m.

Dr. Field presented an address on the subject of "Water Pollution," which was discussed.

Adjournment then taken until 9.30 a.m. next day.

Thursday, September 5, 1912, 10 a.m.

Meeting called to order at same place by the President.

PRESIDENT: I would like to hear from any standing committee before we go to any other part of our business.

ELECTION OF OFFICERS

MR. SEYMOUR BOWER: The Committee on Nominations is ready to report at any time.

PRESIDENT: We will hear the report of the Committee on Nominations.

MR. BOWER: I will say in behalf of the committee that to a great extent we followed usage and precedent, so far as re-elections and promotions are concerned. We also, of course, took into consideration the geographical situation,

as nearly as we could, and last, but not least, the usefulness to this Society and fish culture generally, past, present and prospective, of the gentlemen named. After considering these qualifications and taking into consideration the other points mentioned, we recommend the following names:

President: Dr. Charles H. Townsend, New York.

Vice-President: Dr. Henry B. Ward, Illinois.

Recording Secretary: Mr. Ward T. Bower, Washington, D. C.

Assistant Recording Secretary: Miss Ethel M. Smith, Washington, D. C.

Corresponding Secretary: Dr. H. M. Smith, Washington, D. C.

Treasurer: Mr. C. W. Willard, Rhode Island.

Vice-Presidents of Divisions:

Division of Fish Culture: Mr. James Nevin, Wisconsin.

Aquatic Biology: Prof. L. L. Dyche, Kansas.

Commercial Fishing: Mr. W. J. Hunsaker, Michigan.

Angling: Mr. H. Wheeler Perce, Illinois.

Protection and Legislation: Dr. T. S. Palmer, Washington, D. C.

Executive Committee: Mr. D. B. Fearing, Chairman, Rhode Island; Mr. N. R. Buller, Pennsylvania; Mr. Ernest Schaeffle, California; Mr. J. Q. Ward, Kentucky; Mr. Dwight Lydell, Michigan; Mr. G. W. Miles, Indiana; Mr. George H. Graham, Massachusetts.

All of which is respectfully submitted by the Committee on Nominations.

Mr. Willard called attention to the fact that Dr. Smith and Miss Smith would be unable to serve.

The report of the committee was adopted unanimously, with the omission of the names of Dr. Smith and Miss Smith.

Subsequently, Dr. George W. Field, of Massachusetts, was unanimously elected Corresponding Secretary.

PRESIDENT: We would like to hear from Dr. Townsend, our new President.

REMARKS OF PRESIDENT-ELECT

DR. TOWNSEND: Fellow members, I had the misfortune yesterday to lose part of my voice; I wish I had it all, so that I could express my appreciation of the privilege of being made President of this Society. It is a Society with an ancient and honorable record. I have only been a member of it for a dozen years; there are men still living who have been members three times as long. The Society has done a good work, and the history of the Society will be practically a history of fish culture in this county, and to a large extent the development of fishery industries in this country.

The Society has published very creditable proceedings for many years. I should only place these documents second to the voluminous reports and bulletins of the United States Bureau of Fisheries. But even in the publications of the Government I claim credit for this Society, because many of the most important contributions to Government publications have been made by members of this Society, while they were in Government service, and some of them have been in Government service for many years.

I was very glad to hear the Publication Committee discussing the matter of doing even more with our publications. I was greatly pleased last year when I learned that Mr. Fearing was having a full index of our publications made. This will be of great value.

Now, as the head of a very large museum devoted to aquatic life which has a laboratory, I have a great deal to do in pointing out to people who are looking for information, the sources of information on fish culture, fisheries, and ichthyology. I use the publications of the Government a great deal; I use to some extent the publications of the states, though not generally voluminous, and I use the publications of the American Fisheries Society a great deal.

I hope that we will succeed in getting our publications in the public libraries, where people can have access to them

just as they can to the publications of the Government. Of course, the Government publications are issued in large editions, and are distributed first of all to libraries. The publications of the Government constitute a great encyclopedia of American fishery matters and are absolutely indispensable; and next to that come our own publications.

We really ought to republish our earlier volumes, so that we may have complete sets in our principal libraries. When the new aquarium in New York is dedicated, two or three years from now, I hope we can help to celebrate the occasion with a great meeting of the American Fisheries Society. Perhaps at that time I can offer you a home for a library of this Society. I do not really know how much of a library we have, but no doubt the Secretaries of the Society have publications that belong to this Society and that are of value and should be gathered together somewhere.

In conclusion, I will venture to speak for those who have been elected to the offices of the Society along with myself, and state that it will be our greatest pleasure to do the best we can for the coming meeting of this Society. (Great applause.)

PLACE OF NEXT MEETING

PRESIDENT: Is the Committee on Time and Place of Meeting ready to report?

DR. FIELD: Your committee has considered the matter of time and place of meeting very carefully. The Society had been canvassed, and we feel that there is a very strong sentiment in favor of Boston for the next place of meeting. The reasons which have led to this conclusion are somewhat as follows: There has just been opened this year an aquarium in Boston in which I am sure all the members will be interested; next year will be built, probably, the largest fish market in North America, and possibly in the world in which

it is hoped to introduce the most modern methods of handling fish. This also will be of very special interest.

In addition to that, as you know, at Boston there is now being developed a new method in America of catching fish—the beam-trawl method. The members will have a chance to inspect perhaps together on a trip on one of the trawlers, this method of catching fish.

We are doing an increased amount of work in the propagation of trout and bass and other fish in Massachusetts. All this, I say, is in addition to the fact that the state officials, the Governor of the commonwealth, the Mayor of Boston. and others will be actively interested in everything which this Society may do.

We received a most cordial invitation from the State of Indiana, through the Board of Trade of Indianapolis, which we considered very carefully. In the selection of Boston we have, in accordance with custom, considered the future distribution of meetings, to meet the needs, so far as possible of all the members. So far as we have worked the problem out we are simply making suggestions. While we are making a definite recommendation for Boston, we are suggesting that the next meeting be held in the Mississippi Valley, and the following year at San Francisco, in connection with the 1915 exposition; all of which we incorporate in the report.

Motion made and seconded that the report be adopted.

After considerable discussion as to the advisability of committing the Society with regard to meetings so far in the future, Mr. Bower moved as an amendment that the report be adopted with the exception of the reference to the 1914 meeting being held in the Mississippi Valley.

Motion seconded and unanimously carried adopting the report as amended.

Mr. Schaeffle presented invitations from officers of the Panama-Pacific Exposition for the Society to hold its 1915 meeting in San Francisco.

A formal invitation was received to hold the 1913 meeting at Indianapolis.

TIME OF NEXT MEETING

Mr. Graham then inquired if the time was to be set for the next meeting. After some discussion it was decided to leave the matter to the incoming Executive Committee.

The President then read a telegram from Mr. George M. Bowers, United States Commissioner of Fisheries, Washington, D. C., conveying his best wishes for the success of the meeting of the American Fisheries Society and expressing his deep regrets at not being present.

Dr. Townsend then delivered an address on "Legislation Regarding the Seal Fisheries of the Pribilof Islands," which was discussed.

A paper on "The Catfish as a Host for Fresh-water Mussels," by Mr. A. D. Howard, Biological Station, Fairport, Iowa, was read by Dr. R. E. Coker, and discussed.

Dr. R. E. Coker, Director Biological Station, Fairport, Iowa, then gave a Demonstration of Free Pearls and Their Forced Production.

Mr. W. O. Hart, of New Orleans, then gave an address on "The Fish and Oyster Industry of Louisiana," which was discussed.

Mr. H. D. Dean, of Montana, then gave an address on the Grayling, which was discussed.

Recess then taken until 2.30 p.m., same day.

Meeting called to order by the President at 2.30 p.m.

A paper was then presented by Dr. Henry B. Ward, of Illinois, on the subject, "The Preservation of Our Fish Fauna." Discussion followed.

The following papers were read by title:

"Publicity," by Mr. B. G. Merrill, Hinsdale, Ill.

"Federal Control over Fish in Boundary Waters," by Mr. Henry Hinrichs, Erie, Pa.

"Cestode Cysts in the Flesh of Marine Fish and Their Bearing on Food Values," by Dr. Edwin Linton, Washington, Pa.

"Failures of Fertilization," Anonymous.

"A List of the Fishes Found in the Salt and Fresh Water of the State of Louisiana," by Frank M. Miller, New Orleans, La.

PRESIDENT: We will now hear from the chairman of the Committee on Resolutions, Dr. Ward.

REPORT OF THE COMMITTEE ON RESOLUTIONS

DR. WARD: The committee has considered the resolution as to the length and weight of whitefish drafted by Mr. Wilson and read yesterday by Dr. Palmer at the conclusion of Mr. Wilson's paper. In view of the fact that different authorities, state and national, have different opinions in regard to this problem, it did not seem wise to propose that this Society at the present moment should put itself on record as favoring positively and exclusively any one method. Consequently no action was taken on the resolution.

The following resolutions have been approved by the committee:

Resolved, That the thanks of the American Fisheries Society are due in especial measure to Mr. S. F. Duyyen, President, and to the management of the Albany Hotel for the numerous courtesies shown, and particularly for the magnificent game banquet on the closing day of the session.

Resolved, That the Society owes to its retiring President, Mr. S. F. Fullerton, to its energetic and most efficient Secretary, Mr. Ward T. Bower, and to its devoted Treasurer, Mr. C. W. Willard, a debt of gratitude for unstinted service in its behalf.

Resolved, That the American Fisheries Society expresses its thanks to the Denver Convention League, the Mayor of Denver, and to the Hon. James A. Shinn, State Game and Fish Commissioner, for the splendid hospitalities extended to its members at this meeting.

Resolved, That a vote of thanks be tendered to the Hon. W. L. May and his associates on the local committee for their careful preparations which contributed so markedly to make this meeting a success.

Resolved, That the Society express its thanks to Mrs. Mary Pell and Dr. George W. Pell for the unique banquet tendered to visiting members on Wednesday evening.

Resolved, That the American Fisheries Society extends its warm thanks to Judge Beaman for his constant and successful efforts for the comfort and enjoyment of members.

Resolved, That the Society learns with regret that Dr. Hugh M. Smith finds it impossible to continue to serve as its Corresponding Secretary, and hereby tenders to him its sincere thanks for the time and attention he has devoted to the duties of this office, resulting in many valuable reports and contributions which are a part of the permanent records of this Society.

WHEREAS, the Congress of the United States has passed an act to give effect to the convention between the United States and Great Britain, Russia and Japan, having for its primary object the suppression of pelagic sealing, and

WHEREAS, this measure was amended so as to establish a five-year closed season on male seals on the Pribilof Islands, contrary to the advice of the United States Bureau of Fisheries and its advisory board, including the best informed scientists of the country, all personally familiar with the islands and the fur-seal problem, and contrary to the expressed opinion of others personally familiar with the conditions of seal life on the Pribilof Islands, now therefore be it

Resolved, That the American Fisheries Society places on record its deep regret, that Congress should have acted contrary to the advice of the recognized authority of this country in such matters, and be it further

Resolved, That this Society recommends the early repeal of this provision, which is contrary to all biological experience and which can lead only to dissatisfaction and the ultimate exploitation of the seal fishery by private interests, and with detriment to the herd, consequent financial loss to the Government, and loss of prestige to the nation.

WHEREAS, The fisheries of certain states are being unnecessarily depleted by unwise local regulations, and

WHEREAS, The shad and alewive fishery among others are of special importance (apart from their direct food value to man) by attracting to our coastal waters the more valuable predatory fish, and

WHEREAS, The alewive fisheries are frequently notoriously mismanaged by town and county officials, be it

Resolved, That this Society urges upon every citizen and every state the increasing importance of adequate development of these fisheries under competent national and state direction and authority.

WHEREAS, There has been brought to the notice of the American Fisheries Society, the deplorable depletion of streams by reason of the unprotected head-gates of irrigating ditches,

Resolved, That we, The American Fisheries Society in convention assembled, do most earnestly recommend to the Fish Commissioners of the states where streams are drained of fish by such ditches, the urgent need of the enactment of laws for the protection of fish from said ditches; and be it further

Resolved, That we urge upon the Department of Commerce and Labor the protection of all head-gates to Government irrigation canals, now a great cause of draining our streams of fish.

WHEREAS, The rapid decrease in the fish supply of our waters threatens the ultimate extinction of many types of fish life which are of interest to the student and of importance in preserving the biological relations between aquatic organisms, and in giving future generations an idea of the wild life of American waters, and

WHEREAS, The utilization of stream waters for domestic and commercial purposes is growing so rapidly with the advancing population of the country and with the increasing development of natural resources as to indicate clearly the complete transformation of all water systems in the early future, unless definite measures be taken to provide for this contingency, therefore be it

Resolved, That the American Fisheries Society urges upon the proper authorities in the nation and in the various states the necessity of taking immediate action to set aside fish refuges or aquatic preserves in which the contamination of the water and any modification of natural conditions for aquatic existence shall be forever forbidden, and

Resolved, That these reservations be so located and distributed throughout the country as to provide for the preservation for future generations of representative tracts of water systems which naturally serve as breeding places and as living grounds for the various types of fish and other aquatic forms, and finally, be it further

Resolved, That the Chairman of the Executive Committee be instructed to send to the President of the United States, to the Governor of each state, and to the State Game and Fish Commissioner thereof, a copy of this resolution, with a letter calling attention to the importance of the matter and urging that careful and early consideration be given the problem and that definite action be taken to set aside and protect such fish reserves.

Motion made, seconded and unanimously carried adopting the report of the committee and adopting separately all resolutions recommended by the committee.

PRESIDENT: I want to thank the members of the American Fisheries Society for the courtesies extended to me as their presiding officer; I know that I have fallen far short

of what I ought to have accomplished; but you bore with me and I appreciate it. I now declare this convention adjourned sine die.

COMPLIMENTARY DINNER

On Wednesday, September 4th, 9.30 p.m., Mr. George W. Pell, Jr., gave a dinner to the members of the American Fisheries Society at Pell's Fish and Oyster House, 520 Sixteenth St., Denver, Colo. Descriptions of various fish were given, and addresses made, all winding up with a dinner which lasted until midnight.

BANQUET

On the last day of the meeting, a banquet was given at the Albany Hotel. It was a great banquet. It was a feast without price, for the game wardens and the fishery society men alone, of all in the United States, could give such a dinner. And Colorado, with Col. James H. Shinn, State Game and Fish Commissioner, as host, could alone, of all states in the Union, furnish the viands that were served.

Colonel William Jennings Bryan was called upon to make a speech. He avoided politics. He spoke for the further conservation of the fish and game of the country, and said he would help as he could to that end. Later Mr. Bryan became a member of the organization whose guest he was.

"I have attended many banquets," said Mr. Bryan, "but here I feel like a fish out of water, I am out of my element."

"I have a speech for every ordinary occasion. I have the political speech, I am always ready with the graduation day speech. I know what to say to a Labor Day crowd, and I am at home at a farmers' picnic, at a Y. M. C. A. gathering, a women's seminary, but here I am stumped."

Mr. Bryan said he never had been a hunter. He said after he had finished a political campaign he was always looking

for something that ran and hence big game did not appeal to him.

In conclusion the Democratic leader said he would work as best he could to preserve the game and bird life for future generations.

Judge D. C. Beaman was toastmaster at the unique feast. In introducing Colonel Bryan, he said there was an "open season" on presidents with the exception of the Bull Moose.

The service and cooking of the wild game by the Albany Hotel management was all that could be desired. Old hunters, who had been called back to other days by the food prepared for them, said that it tasted even better than before the campfires of the long ago.

The game and fish was provided by Colonel Shinn from animals that were set aside for natural history specimens, and hence no law was really broken in the giving of the dinner. "It was a great spread," said all who attended, "and we may never get another such chance."

Colonel Shinn welcomed the banqueters. Mr. Samuel F. Fullerton, President of the American Fisheries Society; District Forester Smith Riley, Mrs. Mary C. C. Bradford, Dr. T. S. Palmer, of the United States Biological Survey; Dr. Henry B. Ward, of the University of Illinois, and Mr. Daniel B. Fearing, of the Rhode Island Fish Commission, were the other speakers. Mr. George W. Pell assisted in the preparation of the dinner.

In Memoriam

RICHARD O. CHENEY

JAMES CRUICKSHANK

S. L. FRENCH

H. G. SAUNDERS

J. M. K. SOUTHWICK

LIVINGSTON STONE

PART II

PAPERS AND DISCUSSIONS

A DEFENSE OF THE HUMBLE DOGFISH

By George W. Miles

When the white man first came into the West, bringing with him the pride of his modern civilization, he found the lakes and streams swarming with splendid game fishes. Bass there were in such great numbers that, though they were of size and strength to make them respectable, the taking of them was hardly considered proper sport, its accomplishment was so easy. There were pike and pickerel of weights up to twenty pounds and more, and sometimes muskellunge still larger, to test his tackle and his skill, and these did he prefer to pursue, their capture being more in keeping with his estimate of his own dignity and prowess. All these were admitted to his table and proudly offered to his guests, not because of the superior excellence of their flavor (which was excellent indeed) but because of the vanity of the master of the household, whose sportsmanship was thus best exploited.

Bluegills, crappies, bullheads, perch and other humbler fishes were there also in these lakes and streams in countless numbers, created to be caught by the women and children (and probably intended to be eaten that their joy in the catching of them might not be marred), and these, too, were admitted to the table on ordinary occasions, always to the humbling of the pride of the master of the household, however, who never failed to apologize for the presence of them if a guest was at the board.

Now, as the early Hoosiers would have said, "betwixt and between" these was another fish in which the waters also abounded, and in which they abound even to this day, which, although its size would have entitled it to respect, was so utterly stupid that no man of the time with a drop of sportsman's blood in his veins could feel any pride in pursuing it, while, on account of its great strength, it was much in dis-

favor with the children, whose precious hooks and lines it innocently broke or made off with. And the fates had been unfair enough to give to it the name of dogfish, for no reason that any person could ever explain. And for the reasons I have given the dogfish was despised, and its flesh remained untasted.

For the reasons I have given, and still another reason. The Indians ate them! The Indians ate dogs, too—and there was the name! Ugh!

In truth, the Indians probably ate them for the very best reason in the world—that they are good to eat. But they made use of them almost to the exclusion of the other varieties I have mentioned, possibly not because they preferred them, but because they could secure them more easily than they could the others; for, you know, an Indian never fails to follow the lines of least resistance. I have told you of the dogfish's stupidity. He will bite at any sort of a bait, be it alive or dead, large or small, and get himself fastened on any kind of device; or he will lie still in shallow water until you slip a noose around his neck and pull him out. And so the Indians could get him easily, while it was difficult for them, being without fish hooks or spears or nets, as they were, to secure any other fish.

Did you ever see an Indian cook anything? If you did I warrant you had no stomach for food of that same kind for many a day thereafter while the memory of their culinary process remained acute. I cannot tell you how they cooked dogfish, and I would not if I could, for I want that it shall be forever forgotten, as I shall show you before I am through. But I have been told how they cook a dog—and so have you, I doubt not.

And so the poor dogfish, for no fault of his own, was placed under the ban as an outcast, despised by all members of society, and no person who had any care for his good name or reputation dared taste the flesh of one. There were a few. just one now and then, who defied the good opinion

of their neighbors and ate of them, and every one of these always thereafter stoutly defended them as being of fine flavor, but his opinion was ignored as unworthy of attention. Children were taught at their mothers' knees that if they would keep their good names and hold honored places in society they must not eat dogfish! All men and women in Indiana and her neighboring states have grown up with this prejudice imbedded deep within them, so that if you ask any one of them if dogfish is good to eat *he* will rather question your sanity than answer you with a simple "No." And to ask a man if he ever tasted of the flesh of one is to insult him. Would he so far forget his place in life as to do such a disreputable thing! (But let me tell you in confidence—I know a lot of proud gentlemen who would be deeply wounded if you asked them such a question, who have feasted on dogfish and praised it most highly; but they did not know what kind of fish it was when they ate it. And I am not going to tell you who they are.)

Mr. William T. Hornaday, the director of the New York Zoological Park, has written a book on natural history, and he gives much interesting information about the dogfish. He says of it: "To naturalists, the Dogfish is a creature of much interest. Like the prong-horned antelope, it is so unique and peculiar that it has been necessary to create for it a grand division of classification which it occupies all alone. The antelope is only a Family, but this fish is a whole Order. Its other English names are Mudfish, Bowfin, Grindle and Lawyer; and since Linnæus christened it *Amia calva* in 1766, eleven other naturalists have given it eleven other names in Latin.

"The dogfish has an air-bladder that is divided into cells, and is a half-developed lung. At intervals it ascends to the surface of the water, gulps down a mouthful of air, just as a turtle does, and descends again. If hindered from rising when the time comes to take in a supply of fresh air, the fish struggles violently, like a mammal about to be drowned;

but it can expel air while below the surface. This character indicates that lungs were first developed in fishes, from modifications of their air-bladders." For all of which we thank Mr. Hornaday. But why should he leave off talking as a scientist, about things he knew very well, no doubt, to tell us, in an unscientific way, what he knew nothing at all about that: "save to the negroes of the South its flesh is quite unpalatable, and valueless as food"? Here is a case of false training in youth. For I will wager that Mr. Hornaday never tasted the flesh of a dogfish, unless he thought it was that of a catfish or pickerel. And if he ever did that, I will wager again that he declared the flavor of it to be splendid, just as many other good people have done when they were similarly deceived. Anyhow, we do not need a scientist to tell us whether the flesh of a fish has a good flavor, or whether it has not.

I never yet have known anybody, either a negro of the South, or a white man of the North, who has eaten of the flesh of a dogfish which has been properly dressed and cooked, but admitted the flavor of it to be as fine as that of a bass or of a pike, which latter it much resembles; though I have known of a great many epicurean people doing this who would not have eaten of it at all if they had known it was a dogfish. The only ones I have found who told me that dogfish are not good to eat have been those who never tasted of them.

Now, all the lakes and the streams of the Middle West abound in this beautiful fish, and if people made common use of them, as they ought to do, and as they do of bass, pike, catfish, sunfish, and perch, the flesh of none of which has any better flavor than has the flesh of the dogfish, the value of our waters as food producers would be greatly augmented.

Wherefore, let me beg of every person who has never eaten of dogfish (or who does not know it if he has), and who has always believed them to be unfit for food because

about everybody else seemed to think they were, that he lay aside his prejudice long enough to give the matter at least one honest test.

Before you do this, however, I beg of you that you let me advise you carefully as to how the fish should be dressed and made ready for cooking, for I would have the test a fair one, otherwise the fish may be condemned on account of its not having been properly prepared and for no fault of its own. Not that any particular method is necessary for the preparation of this particular fish, but a dogfish is large and his body is round and thick, and if the dressing be not properly done, the pieces of its flesh will not be cooked through, and rare fish of any kind is an abomination.

Many people have told me that they liked small bass but not large ones, which they asserted tasted "mossy." I know that the large bass was improperly dressed, otherwise, with similar cooking, its flavor would have been exactly the same as that of the smaller one. Others have said that they disliked pickerel or pike. There is no finer fish in any of our waters than these. They are just about as good as dogfish. But the bodies of them are also round and thick, and they can not be properly cooked if the skins be left on them and the "backbones" be left inside them. And the same thing is true of all large fish, including carp, which, when properly prepared, are very, very much better fish than you have ever given them credit for being.

But to return to our dogfish: First take the skin off him. It is thick and tough and his flesh can not be well cooked through it. You can do it more easily than you can take off his scales, in the following manner:

With a sharp pocket knife rip his hide down the belly and back, from the head to the tail. Now tack his tail fast to a board, cut the skin around the tail and start it with your knife until you can grasp it with a pair of pincers; then pull steadily, following along and parting the skin from the flesh lightly with the knife, as though you were skinning a

muskrat, or other fur-bearing animal. Draw the nails, turn the fish over, and repeat the process on the other side. Now cut off the head and tail and remove the entrails. The body of the fish, solid and firm and of a reddish color, much like that of a bullhead catfish, will appear appetizing to you. Next lay it down on the board, belly uppermost, and with your knife separate the ribs from the "backbone," cut the flesh free from this bone and take it entirely out. You will now have all the valuable flesh of the fish in two slabs which, when washed and cut into pieces of the proper size, will be ready for the frying pan.

In this frying pan have fat enough that these pieces will almost float, and fry them much as you would doughnuts. Have it good and hot when the pieces, first coated with flour or cornmeal, are dropped into it, and keep it thus until they are fried nearly as brown as doughnuts. Then with a fork lift them up, allowing the hot fat to drain from them, and serve.

I have advised the skinning of a dogfish from the tail toward the head, because the skin of it, which adheres rather tenaciously to the flesh, is more easily removed that way than if pulled from the head downward. The same is true of a pike or a pickerel, on which the skin also sticks hard to the flesh. Neither of these fish should ever be cooked with the skin on it. Bass, crappies, bluegills, sunfish, and perch may be skinned easily, and the flavor of every one of them will be vastly improved if it be skinned before it is cooked. But whether it be skinned or not, any fish weighing more than a pound should have the backbone removed from it before being fried.

Now I beg of you that you put away the old prejudice that you have carried with you all your years without reason. Give the dogfish a fair and honest trial. If your verdict be that his flesh is not good, I will abide by it; on the other hand, should you agree with me that it should be eaten, much value will be added to our lakes and streams,

for he is easily propagated, and, notwithstanding the wantonness with which he has been sought out for destruction, his numbers are legion in all the waters of the West.

DISCUSSION

PROF. L. L. DYCHE, Pratt, Kan.: Is that the same species of dogfish that is found in Lake Michigan?

MR. MILES: Yes.

PROFESSOR DYCHE: In 1895 I caught dogfish at Charlevoix, Mich., cooked and ate them, and found them much like catfish. I have also eaten dogfish cooked by Indians.

MR. W. H. HUGHES, St. Louis: You think they do not interfere with the stream or the growth of the game fish?

MR. MILES: No, they are a benefit to them. The dogfish is quite prolific.

MR. DWIGHT LYDELL, Comstock Park, Mich.: I had not expected to tell of my experiences in eating dogfish. I was not going to say anything about it until Professor Ward came in, and I knew I had a witness to verify my statements.

We ate them at Charlevoix. While we were studying the habits of the whitefish we experimented eating everything that the lake would produce, even to lawyers and mud-puppies. When people begin to eat dogfish, I am ready to eat most anything.

PRESIDENT: I am sure that the Society knows dogfish are not harmful, after they have looked at the two splendid specimens of physical manhood who admit experimenting with them.

MR. W. E. MUSGROVE, Leadville, Colo.: What do dogfish eat? Do they eat the same food that the game fish subsist on?

MR. MILES: Altogether.

MR. MUSGROVE: Then we don't want them.

MR. MILES: Nature keeps up a nice balance in these matters. We have garfish, big pickerel, pike and dogfish all dwelling together in harmony.

MR. MUSGROVE: But one lives at the expense of the other.

MR. MILES: But remember that the young dogfish are excellent food for bass and other game fish. I am commissioned by the Commercial Club, of Indianapolis, to induce this Society to meet at Indianapolis next year, and if you do we shall offer you a dogfish dinner at one of the hotels, and ask you to pass judgment on it without prejudice.

MR. D. C. BEAMAN, Denver: I move that the discussion of the dogfish matter be laid on the table until next meeting.

MR. SEYMOUR BOWER, Detroit, Mich.: I have never eaten the dogfish, but I think Mr. Miles is correct when he says they are wholesome food. A number of years ago I was employed at the Put-in Bay hatchery

of the Bureau of Fisheries. Mr. Stranahan, the superintendent, claimed that every species of animal, land or water, is suitable for food. Some, of course, are not as toothsome as others, but all are wholesome, more or less palatable, and nutritious to some degree. When fishing through the ice we caught a good many mud puppies, commonly known as "water-lizards." They are quite numerous in the shoal waters of Lake Erie, and certainly very repulsive in appearance. At first I did not dare take them off the hook with my hands, but I soon got over that. One day Mr. Stranahan said: "I am going to eat one of these mud puppies." He wanted me to join him. My prejudices would not allow me to do so, but he dressed one, put it on a shovel, took it to the furnace in the engine room, cooked it over the coals, brought it into the office, salted and peppered it, ate it with a great deal of evident relish, and said it was just as good as whitefish. I can testify that it looked as good, smelled as good, and that the flesh was white, firm and flaky and apparently all right. He prophesied that some day it would be considered a great delicacy and sought for the same as turtles and frogs, which were once tabooed, just as the Menobranchus is today—the mud puppy.

There is no good reason why the dogfish should not be eaten; but I believe that, in view of the rapidly increasing price of fish and the fact that a great many fish within the memory of nearly all of us which were not marketable at all, are now bringing a good price, the day is not far distant when the dogfish will find ready market at a fair price.

MR. C. K. CRANSTON, Pendleton, Ore.: I never saw a dogfish, and do not know what they look like; but I want to ask Mr. Miles if it is not possible that the food upon which the dogfish may have subsisted may not have had something to do with its flavor. As a reason for asking this question I want to say—and I think you will all agree with me—that the rainbow trout is a very fine fish, but it may surprise you to hear me say that I have tasted rainbow trout that were not fit to eat; and that I attributed it to the fact that the ones that were not eatable were those that had subsisted on the wrong sort of food. It may be possible that the dogfish which were first pronounced of bad quality had fed on bad food. I have eaten rainbow trout of all degrees of excellence from, I suppose, the best fish that the Lord ever made, down to those that, when taken in the mouth, were so unpalatable that you would have to spit them out.

MR. MILES: I have known them to be thrown back, when fish were plentiful; but the dogfish is as beautiful as the bass or the trout; there is nothing unsightly about him, and he lives on the same food as the bass.

PROF. H. B. WARD, Urbana, Ill.: As this seems to be an experience meeting, I might say a word with reference to the subject matter of the discussion. Give an animal a bad name and hang it. Really the name dogfish is not properly applied to the fish in question. As those

who are familiar with salt water fish know, the dog fish proper is a type of small shark; and this inland water fish ought to be called the bow-fin, or some other suitable name, because it has absolutely no relationship or likeness what ever to the marine dogfish.

There is no reason why a bow-fin should not be perfectly good to eat, and there has been sufficient testimony on that point, I believe; yet I confirm all that has been said in regard to it.

I want to add one word also with reference to the mud puppy, so-called, which is another instance of an animal being condemned on account of its name, or possibly on account of its looks. It is a first cousin to the frog, and there are some of us who occasionally pay a good price to get fried frog legs; yet the meat of the so-called mud puppy or the *Menobranchus,* is the same as the meat of the frog; it is really a more solid meat; and if there are any here who enjoy frogs' legs they can get a larger quantity of the same meat at a much cheaper price by buying the animal which has been condemned under the evil name of "mud puppy."

Both the fresh water dogfish, or bow-fin, and the mud puppy are good livers, and are entitled to be added to the list of delicacies which the human race enjoys.

It is quite appropriate that this Society should extend the list of table fish, for with the disappearance of some of the kinds to which we have been wedded in the past, there is need for something which will be within reach of the pocketbook. Now, the bow-fin and the mud puppy will actually take the place of any high grade fish, and of frogs' legs. Therefore, those who are here can with great safety propagate the gospel of these new delicacies, and they will find that when they add them to the menu, if they will simply change the unsavory names, people will think they have one of the greatest delicacies of the season.

PRESIDENT: Through this dogfish discussion we may have found out something of great value.

THE GAR PROBLEM

By E. E. Caldwell

Of all the enemies of the fishes indigenous to the waters of Illinois, the gar, *Lepisosteus osseus,* is at the head of the list, not only as a voracious consumer of other fishes, but also as a destroyer of the food used by the game fishes.

Forbes and Richardson, in their book, "The Fishes of Illinois," have this to say of this greatest pest we have in the waters of the state:

"This voracious, active, and well-protected fish is a notable winner in the long struggle for existence which its species has maintained, but it is a wholly worthless and destructive nuisance in its relations to mankind. It is the enemy of practically all the other fishes in our waters, and so far as it eats anything but fishes, it subtracts from the food supply of the more valuable kinds. It has, in fact, all the vices and none of the virtues of a predacious fish. On the other hand, it is preyed upon by nothing that swims, and is so well adapted to the varied features and vicissitudes of its habitat that it is proof against any but the most extraordinary occurrences.

"From its long cylindrical shape and its activity when alarmed, it is not as likely to be held by the fishermen's nets as most other fishes of its weight, and it consequently survives on our fishing grounds in very disproportionate numbers, and diminishes their average productiveness in no small degree.

* * * * * * * * * * * * * * *

"The gar is a voracious feeder and is especially destructive to minnows and the young of other fishes. The stomachs of specimens examined by Dr. Dean contained nothing but small soft-rayed fishes, less than 3½ inches long. Eleven small minnows were taken from the stomach of one male 24 inches long, and 16 from the stomach and pharynx

of another 27 inches long. * * * Sixteen minute minnows have been taken by us from the stomach of a single specimen 2 inches long, * * * The abundance and destructiveness of gars in particular localities have recently led to serious efforts at extermination and pound-nets have been found quite useful for this purpose. * * *

"Their earliest food is apparently *Entomostraca,* but they begin at a surprisingly early age their life work of keeping down the fish population of the waters they inhabit. A specimen only an inch and a quarter long, examined by us, had taken a minute fish, and another two inches long and only an eighth of an inch in depth had filled itself with no fewer than sixteen very young minnows."

A volume of text would not give a better idea of the destructive and worthless nature of this pest. The State Fish Commission of this state has taken up the work of the destruction of the gar in portions of the waters of the state, so far as the limited amount of money at its command would permit. A law enacted by the Forty-fifth General Assembly made it the duty of commercial fishermen to kill and bury or burn all gars taken in their nets and seines, with a penalty for failure to do so, but its observance was the exception rather than the rule. A few who recognized its value as applied to their business in the future did destroy them, but the larger number, in their haste to secure the fish they wanted, simply threw them toward the shore and let it go at that.

So great has been the loss in the young of other fishes, that the Commission decided on making a warfare against the gar the principal part of its work, since the legislature had refused to make an appropriation for the usual work, the collection and distribution of our native fishes, so we have used the steamboat and crew, together with the seining gangs, in this work. We used the gill nets at the start, but found more practical results were to be obtained by the use of a small meshed seine, made of heavy twine. We have

interested as many of the commercial fishermen as possible in the work, and, if it could be made general, the resulting reduction of the gars would be of immense benefit to their interests.

Very large hauls of gars have been noted late in the fall and early in winter when they congregate in certain parts of the rivers and are to a certain extent sluggish. One haul of several hundreds of thousands was noted. At the present writing the rivers fairly swarm with them, so plentiful are they that in passing over them with a boat, the oars hit them at almost every stroke. To go about the work of extermination successfully would take more money than we have at our disposal, but what we have is being used in that way. So far this season we have taken half a million or more, and hope to increase that number by many times before the season is over. I believe that if this work could become general all over the state, it would be the means of greatly increasing the supply of food fishes and their food. In Lake Mantangas, which is controlled by the State Commission, we note a wonderful improvement following the attempt to destroy gars. Some of the specimens attain a large size, and their destructiveness is in proportion, while the small ones are equally busy, but with smaller fishes. With the small meshed seine we take the small gars in great numbers, and when we are so lucky, or *un*lucky, as to get a bunch of big ones in a haul, it is generally at the expense of the seine, as "they go right through it," according to the foreman of the seine gang.

We hope to get such legislation at the next session of our legislature as will enable us to prosecute the work systematically all along the line.

Perhaps an illustration of the destructive qualities of the gar would be not out of place. On August 8, 1912, a pond back of the reservation at La Grange Locks was reported to us as being very low, and the fish in danger of perishing and becoming a nuisance. We sent a gang there with small

meshed seines to clean it out and put the fish into the river. The pond, made by the overflow of the river, covered during high water several acres, but was then drawn down so that only a small area was left, with the water only a few inches deep. We took from the pond 1500 gars, mostly large, and about the same number of adult food fishes, bass, catfish, carp, and crappie, but no small ones. A week later we cleaned out a large pond at a point below, taking a large number of adult fishes and thousands of small fry, such as shad, perch, catfish, minnows, etc., but no gars. At the mouth of every creek and stream flowing from an inland lake, these gars congregate, and the destruction to all small fish life is almost incalculable, and certain extermination of this small life follows when the receding waters leave gars with them. This seems to me to be a subject deserving the attention of all who are interested in the conservation of the native food fishes.

THE CATFISH AS A HOST FOR FRESH-WATER MUSSELS

By A. D. Howard

The rapid growth of the pearl-button industry, with its increasing demand for shells of the fresh-water mussel, has already made it evident that this natural resource is not unlimited and that even a practical extinction is possible. In recognition of this situation the U. S. Bureau of Fisheries has carried on for several years an extensive investigation of methods of artificial propagation.

The interesting relation of parasite to host between the Unionidæ and fishes has long been known. An examination of fishes caught at random plainly indicates that in nature the number of mussels successfully finding a host is comparatively small. Lefevre and Curtis* have demonstrated that in certain cases a single fish may by artificial means be induced to carry several thousand more mussels than it would under ordinary circumstances in nature. Thus large numbers of the young mussels which otherwise would sink to the bottom and die are carried through the most critical period in their life history. The method of infection is as follows:

Young mussels or glochidia produced to the number of many thousands by each female mussel, are taken from the gills of the latter and placed in a receptacle with the fish to be infected. The myriads of glochidia thus distributed in suspension through the water, passing constantly through the gills of the fish, become attached to the filaments of the gills or in some cases fasten externally upon the fins. As soon as they become attached there is a reaction of the tissues of the fish, in the nature of an hypertrophy of the ex-

*Lefevre, G., and Curtis, W. C.: 12 Studies on the Reproduction and Artificial Propagation of the Fresh-water Mussels. Bull. Bureau of Fisheries, Vol. 30, 1910.

ternal epithelium, which produces a cyst enveloping the glochidium. Under normal conditions the young mussel remains encysted long enough to pass through a metamorphosis after which it drops from the fish in a form closely approaching the adult.

A little experimentation shows that, taken a given species of mussel, all fish are not equally susceptible. Some do not readily receive the glochidia, others quickly shed them, while others die from excessive infection. Thus we have in certain instances what has been called an immunity at least to a given mussel species. Lefevre and Curtis find immune to the glochidium of Lampsilis such fishes as the German Carp, certain minnows and darters.

Acting upon the information obtained from such experiments the Bureau has carried on practical work in mussel propagation. Fish in large numbers are infected and released to spread the mussels in whatever waters they may reach. This work, however, has been limited to a few species of the Lampsilis group, chiefly *Lampsilis ligamentina* and *L. anadontoides*. With one possible exception none of the Quadrula group of mussels, including some of the most valuable commercial shells, had up to the time of the present investigation, been carried through the parasitic stage. Many experiments had been made on various species of fish and under varied conditions to determine a suitable method of propagation. The rarity of successful infections and other results would suggest that as in other cases of parasitism in the animal and vegetable kingdom each mussel may have its appropriate host or hosts restricted to a species of fish, a genus or a family as the case may be. Since the number of species of mussel for this locality is forty or more and the number of species of fairly common fish at least sixty, the problem of determining the appropriate host for each mussel is obviously quite complex. To determine the hosts for each species of mussel by artificial infection, a "trial and error" method would be very difficult.

Obviously a more direct solution of the problem would be secured by a study of natural infections, i. e., fish taken at large are examined for glochidia and when present these are determined as to species, condition, etc.

In an investigation of some members of the Quadrula group of mussels which I have carried on this spring and summer the above method was employed. I made examinations of as many species of local fish as were obtainable, identifying as far as possible such glochidia as were found. Some glochidia, because of peculiarities of form or size, were readily determined, while others were less easily identified because of less apparent differences. In this study I found of great assistance the excellent preparations and drawings of glochidia by Messrs. T. Surber and H. W. Clark, of this station, who kindly placed their material at my disposal.

This line of investigation, as well as answering the main question for which it was undertaken, revealed some other interesting points. Among these may be mentioned the predilection of several species of mussel for one kind of fish; for example, "the Sheepshead," *Aplodinotus grunniens,* was found to carry commonly the glochidia of *Lampsilis lævissima, L. gracilis, L. alata, Plagiola donaciformis* and others. This fish feeds upon mussels and so we have an explanation of the presence of these thin shelled species upon its gills.

Another observation for these species, so far as I know previously reported for *L. lævissima* only was the extensive growth beyond the glochidial shell while still on the gills of the host.

Some cases of remarkably full infection have been found, but a small number seems more common for natural infection.

The absence of glochidia uniformly in certain species of fish is quite striking, as in the German carp, *Cyprinus carpio,* Linnæus, mentioned above, as well as the garpike, *Lepis-*

osteus osseus, Linnæus, and the dogfish, *Amia calva,* Linnæus. In some cases the immunity seems to extend to large groups of fishes as for example the Catostomidæ (suckers). The Catfishes have been regarded as belonging among the immune fishes, this opinion being based largely on the results of artificial infection experiments.

In my examination of catfish the results have been largely negative, especially in the spring catches, but on fish caught during July and August I found natural infection. The first of these on *Ictalurus punctatus,* the channel cat, and the second on *Leptops olivaris,* the flathead. The species proved to be *Quadrula pustulosa,* the pimple-back, a common shell of this locality and of considerable importance commercially.

To test for methods of "artificial propagation" I made infections with three species of catfish and two other kinds. The following were employed: *Ameiurus melas,* bullhead, *Leptops olivaris,* flathead and *Ictalurus punctatus,* fiddler. *Pomoxis annularis,* crappie and *Lepomis pallidus,* sunfish. When exposed to infection in the same tank and thus under the same conditions, the difference in susceptibility between the catfish and the other species was very marked and the difference in implantation still more so. The catfish retained the glochidia; while though abundant on the gills of the crappie and sunfish, they disappeared the second day. Experiments to determine the optimum infection were undertaken and a count of eight hundred made upon one fish. In this experiment the fish showed no discomfort nor any signs whatever of impaired vitality, however at the present time the optimum for the mussel has not been determined.

Later observation on natural infection in *Ictalurus punctatus* has yielded further confirmatory evidence that this species is the natural host for *Quadrula pustulosa.* The glochidia in these cases showed an advanced stage in the metamorphosis of the young mussels in which two adductor muscles are apparent and considerable growth beyond the

glochidial shell. Eight out of eleven fish examined were infected and the maximum infection observed (on one fish) was twenty-one.

The results would seem to demonstrate *Ictalurus punctatus* as a natural host for *Quadrula pustulosa* and the experiments so far as they have gone would indicate that other species of catfish may be also. The possibilities offered by the catfish as a medium for artificial propagation are obviously almost ideal. This fish, valuable for food, is abundant and can be transported and handled with less mortality perhaps than any other species. These conditions make the expense of propagation less and the chances of successful distribution in every case greater.

Summarizing the practical results we find the investigation has provided a species of mussel and a species of fish not hitherto available for artificial propagation.

DISCUSSION

DR. R. E. COKER, Fairport, Iowa: We at Fairport, Iowa, are engaged in the propagation of the freshwater mussels which support the important industry of button manufacture. The fishing has been so extensive as to deplete the more important rivers of the country, until the point is now reached where we have to replenish the beds. The method of doing so is this. We take the young stage of the mussel (the glochidium) and get that infected on the gills of the fishes; then, after a certain period of time, or right away, as the case may be, these fish are released in the streams, and the mussels in due course, after the necessary period of parasitism, fall to the bottom, where they can look after themselves. All fishes are not equally susceptible to the mussels; there are some which we cannot now use at all, but the game fishes can all be used to carry mussels of the *Lampsilis* group, and other species of economic importance. There is another group of mussels generally included under the genus *Quadrula* which yield a fine quality of button. Up to the present time we have not been able to do anything with that group of mussels. We now handle lots of others, but not those. Up to this time, also, we have had no use for the catfish, and a great many other of the coarse fishes. So when we seined out the overflow ponds and sloughs we could use the game fishes but had to discard the catfishes.

This paper by Dr. Howard shows some results of the work which he has been carrying on with reference to the quadrulas, mussels which

we could not handle; and he finds that certain catfishes which we had no use for in mussel propagation are the hosts of one of these quadrula species. The *Ictalurus punctatus* is the natural host apparently of the *Quadrula pustulosa* or "warty back"—a useful shell. He has found young mussels on the gills of those fish and he has artificially infected the fish with these mussels, and they have carried them for a number of days. Just at this time he has not carried the matter far enough to know the optimum number, but he has one catfish now that is carrying 800. Of course the game fishes will carry from 1,000 to 2,000 more of the other species. Undoubtedly this catfish would have carried more if it had been loaded more heavily at the start.

DR. TOWNSEND: I have been greatly interested in the Fish Commission reports touching this subject. The dependence of the mussel upon the fish for its distribution is a very fascinating matter. I shall watch the progress of work out on the Mississippi with a great deal of interest.

I am at present writing a report on the new method of pearl shell cultivation on the west coast of Mexico. Last year I visited the great pearl fisheries at La Paz where a Mexican company has been cultivating pearl shell for two or three years. Entirely aside from the pearls that sometimes turn up in the pearl oysters, pearl shell is a very valuable commodity, being worth $300 or $400 a ton according to grade. There is no doubt that the company has greatly increased the supply of pearl shell in its locality, and while they refused to give me any information as to their methods, I was allowed to go over the place and form my own conclusions. I photographed the clusters of young oysters, the trays, the crates of shells sunk in the bay, the zigzag canal in which the crates are placed for the maturing of young, and altogether made two dozen photographs which will show what the method is. The promoters were harvesting the second crop of shells and appeared to have a great quantity.

The success of this work will be important to the ocean pearl shell fisheries of the entire world.

DEMONSTRATION OF DR. HERRICK'S FREE PEARLS OF FORCED PRODUCTION

INTRODUCED BY R. E. COKER

Dr. W. P. Herrick, of New York, has kindly authorized me to demonstrate to the Society a number of pearls produced as a result of artificial stimulation. These pearls, it should be stated at the outset, are not perfect, valuable jewels, but represent the successful achievement of a step, and that a highly significant one, in the solution of a most interesting problem.

For some years Dr. Herrick has been engaged in experiments with the view to determine if it were not possible to cause the production of free, perfect pearls as the result of artificial stimulation.

This work was begun with local species at Quissett, Cape Cod, and Woods Hole, Mass., where the common marine oyster, the hard clam, and a thin-shelled fresh-water mussel were easily available. At a little later stage, Dr. Herrick obtained some pearly fresh-water mussels of the Mississippi River through our station at Fairport; and, beginning with last year, 1911, a good deal of experimentation with fresh-water mussels has been done by him on the ground at Fairport. It may be added that, while we have not been able to extend him any important facilities, and his work has been conducted entirely with the aid of his own private resources, we have viewed the investigation with a great deal of interest.

There were, as he recognized, two stages to be accomplished: (1) to demonstrate by experimentation a practicable method of forcing the formation of free pearls, (2) to make the method applicable to the production of commercial pearls by the appropriate species. For accomplishment of the first stage (the determination of methods) the most common and easily procurable native species were

used as mentioned—the common oyster, the hard clam or Quohaug, and a thin-shelled fresh-water form, *Anodonta implicata*—and this is the material which is available for your observation today.

The material is as follows:

(1) Specimens of the anterior adductor muscle of *Venus mercenaria* showing partially dissected free and complete pearls of forced production (1 year's growth).

(2) One of two living specimens recovered of our edible oyster, *Ostrea virginica,* showing free and complete pearl embedded in the anterior adductor muscle—induced by mechanical means.

(3) Several specimens of the anterior adductor muscle and one of the body of *Anodonta implicata* (from Quissett, Mass.) showing partially dissected free and complete pearls of forced production.

(4) Specimens of minute, round pearls and a "point" from *Venus mercenaria*—forced production, together with free, nacreous masses from body and muscle of *Anodonta implicata.*

(5) Two shells of the common edible oyster, one containing approximately round pearl, pearls formed in the adductor muscle and attached to the shell at the adductor impression. The pearl in each case is supposed to have been formed free and to have acquired a secondary attachment to the shell.

Dr. Herrick permits the following quotation from his letter:

"Several common and easily secured species were selected for experimentation that the comparative physiology might aid (1) in demonstrating a method of forced free and complete pearl production, (2) which might be applied to the production of commercial pearls by the appropriate species. Therefore, of these specimens some are from the marine species *Ostrea virginica* (our edible oyster) and *Venus mercenaria* (the hard-shelled clam), others from a

fresh-water species, *Anodonta implicata,* abundant near by at Onset, Mass.

"You will recall an account of the beginnings of my endeavors given at the American Fisheries Society meeting of 1910, with specimens of the work then proceeding to produce pearl cysts, shown in discussing Professor Dean's announcement that Professor Nishikawa had discovered a method of forced pearl production.

"In the fall of 1911, unfortunately, only two of my marine specimens were recovered, only one of which had been treated to produce a free pearl; this, however, had a round pearl; and, of the fresh-water specimens examined, of four western specimens, one *Pleurobema æsopus* contained a button pearl, and four free, nacreous masses were obtained from nine specimens of *Anodonta implicata.* These latter were very irregular and some flake-like, and those of the marine specimen and *Pleurobema æsopus* might have been natural; so, though they established in my mind a belief that a method had been discovered, they did not seem worthy of presentation until it had been more definitely established.

"These specimens of 1912, however, about two dozen in number, show a definite, free and complete pearl, in the definite place treated, with such regular recurrence, that there would seem to be no good basis for a reasonable doubt of the demonstration of the method. Should there be any question, however, I would wish to have you treat the specimens in any way you see fit, by further dissection or section, decalcification of the pearls, or any other method, as others can readily be produced, but it is most desirable that the demonstration should be satisfactory. As regards the second proposition, viz., its application to the production of commercial pearls in the appropriate species, there yet remains much to be desired; as to species, increased certainty by more accurate technique, improved sphericity, fine lustre, and anatomical location giving better opportunity for larger and more perfect pearls. Therefore, though some

work has already been done along these lines, its commercial applicability must be reserved for the results of present and later experiments, but I believe that a similar method may be further used on the Unionidæ, and possibly applied to certain species of the marine Margaritiferæ.

"It might be of interest in passing to note that, after diligent search and inquiry, I have been unable to find any further records of forced free pearl production with the exception of a record of the late Professor Nishikawa's announcement that he could force the production of free pearls, together with Professor Dean's announcement that he had heard of a demonstration given in Japan by Professor Nishikawa, in which he had certain pearl oysters opened, having predicted that a pearl would be found and that the pearl was found. But apparently no free pearls of forced production have ever come to this country from Japan.

"It would seem, therefore, that the present is as complete a demonstration as has ever been given and apparently the only one outside of Japan.

"It only remains then to express my hearty appreciation of the help and interest so many have shown."

THE FISH AND GAME LAWS OF OREGON

By C. K. Cranston

The enforcement of the laws pertaining to game, game fish and all classes of commercial fish, as well as the management of everything concerning these subjects, is within the control of a non-partisan and practically unsalaried board of five citizens, the law creating the board and delegating to it complete authority over the matters under its jurisdiction having been enacted by the 1911 session of the legislature. Prior to the enactment of this law, all matters pertaining to game laws and game were directed by a State Game Warden, an appointee of the Governor, to whom he was responsible, while all matters relating to commercial fish and fishing were under the direction of a Master Fish Warden, who held his appointment under a Board of Fish Commissioners, which consisted, ex-officio, of the Governor, Secretary of State, and the State Treasurer. The enforcement of the laws pertaining to game fishes was assumed to be jointly within the jurisdiction of the State Game Warden and the Master Fish Warden, but in practice it was largely under the direction of nobody. For a number of years controversies had constantly arisen as to jurisdiction in specific instances, with the result that the law enforcement was almost universally lax, and in many instances farcical.

The 1905 session of the legislature enacted a hunters' license law and the session of 1909 added to that an anglers' license law. The accumulation of the fees accruing therefrom formed a considerable fund, a large part of which was lying in the state treasury, unused, at the time the 1911 act went into effect, on account of the legislature having previously failed to make provisions for its expenditure.

This condition of affairs had created a feeling of dissatisfaction throughout the state, and game and game fish protection was consequently becoming more generally in contempt. The framers and supporters of the new law foresaw

complete extermination of our game and game fish unless existing conditions were remedied, and for that reason advocated an entirely "new deal." The enactment of the 1911 law and the induction into control of the State Board of Fish and Game Commissioners was the result. The law creating the Board requires that four of the members shall be selected by the Governor, that no more than two of these shall belong to the same political party, and that two of them shall be residents of that part of the state lying east of the Cascade Mountains.

The persons chosen by the Governor to compose the four appointive members were Mr. J. Frank Hughes, of Gold Hill; Mr. C. F. Stone, of Klamath Falls; Mr. C. K. Cranston, of Pendleton, and Mr. M. J. Kinney, of Portland. In accordance with the law, these four met and selected a fifth member in the person of Mr. Geo. H. Kelly, of Portland. The Board then organized by the selection of Mr. Cranston as chairman and Mr. Hughes as secretary, and appointed Mr. R. E. Clanton as Master Fish Warden and Mr. William L. Finley as State Game Warden. Mr. Clanton was, and had been for about a year, the incumbent of the office to which he was reappointed. Mr. Finley had had extended experience as agent of the National Audubon Society in protection of bird life within this state but had never served as a state official, nor had he been specifically interested in strictly game regulations.

One of the first rules which the Board laid down to these chiefs and executives was that harmonious action between themselves is absolutely necessary and that on that class of work entirely depends their retention in office. They were given to understand that co-operation between the two departments is and must be a cardinal principle.

Thus organized, the Board has taken active hold of the work before it. The members have visited most of the state properties under the control of the Board. Formal sessions are held about every sixty days when all matters relating to the work over which it has jurisdiction are thoroughly

discussed and orders given and resolutions passed as seems best.

The least radical changes have been made in the policy of the department toward the commercial fishing interests of the state. Most of the regulations which bear on this subject are governed by statute and are, therefore, not subject to any change by order of the Board. Increased energy has been brought to bear on the work of artificial propagation of commercial fishes. This work is directed, as it has been for a number of years by the Board of Fish Commissioners, toward increasing the stock of the several native species of salmon in the waters of the state. All the native species are propagated, but the chief effort is directed toward the keeping up of the stock of the chinook because this particular species is considered the most valuable of the native salmon. The Board is unanimous in the belief that it is wise to hold and nurse as great a number of young fish as possible to an age of from five to eight months before liberating them into free waters where they must shift for themselves and take their chances with numerous enemies and secure their own living. With the object of making better facilities for nursing the young fish to an age suitable for liberation, the several principal hatching stations are being improved by the construction of extensive nursing and rearing ponds. This work is under way at the Central Hatchery at Bonneville and at the Clatsop County Station on the Klaskanine River. Similar construction is begun and well under way at the station on the McKenzie River, as well as at the station on the Wallowa River, and it is intended to similarly equip all the stations in the state as fast as plans can be elaborated. In addition to the work of constructing rearing ponds, the facilities for storage and preparation of fish food are being improved as fast as practicable. At the Bonneville Hatchery a retort for cooking the food had been installed and a power wheel has been built for generation of electrical energy for lighting the place and furnishing power to grind the food. A cold storage

room is also planned for keeping a reserve stock of food. Following the policy of its predecessors, the Board has used large quantities of smelt for feeding salmon fry and this past season forty-two tons were consumed. It has also gathered great numbers of eels which are taken wherever practicable but are mostly obtained at the falls of the Willamette River at Oregon City where, during the late spring and early summer, upwards of fifty tons were secured. Other kinds of food utilized are liver, milk curd, heads and other offal of the adult salmon packed at the canneries, and a wheat product known as "middlings," the latter being cooked thoroughly into mush.

From the spawn taken during the fall of 1911 and winter of 1912, the results obtained at the different hatcheries are shown by the following tabulated statement:

Station	Sockeye	Chinooks	Silversides	Steelheads	Total
Bonneville	1,957,825	10,599.490	589,605	1,225,745*	14,372,665
Klaskanine	.....	2,522,500	377,655	.....	2,900,155
McKenzie	.....	75,000	.....	.....	75,000
Tillamook	.....	646,300	1,578,131	831,000*	3,055,431
Yaquina	.....	148,992	1,554,602	7,145	1,710,739
Alsea	.....	287,645	997,455	.....	1,285,100
Suislaw	.....	715,758	504,429	72,097	1,292,284
Umpqua	.....	1,253,747	.....	.....	1,253,747
South Coos	.....	1,767,170	2,317,370	.....	4,084,540
Coquille	.....	221,740	1,672,850	.....	1,894,590
	1,957,825	18,238,342	9,592,097	2,135,987	31,924,251

*Distributed as game fish.

As mentioned in the early part of this report, practically nothing had been done in the state toward the artificial propagation of native or non-native game fishes up to the time of the creation of the State Board of Fish and Game Commissioners. The judicious expenditure of the funds provided by the payment of anglers' licenses toward the protection and propagation of game fishes was believed by all the commissioners to be one of the chief duties which ought to claim the attention of the Board. After some discussion it was agreed that the first object to be attained was the selection of a location where a large supply of parent or brood fish of game species could be obtained and retained for propagating purposes at a minimum cost. A location in Klamath County on Spring Creek was selected and negotiations have been under way for more than a year in an effort to acquire for the state the necessary ground and water rights to enable a central game-fish egg-taking and hatching station to be established there. The land at this place is within the boundaries of the Klamath Indian Reservation, and up to date the Board has not been successful in its efforts to procure the necessary site. Pending the question of the Spring Creek location, it was not deemed wise to do more than prospect for and inspect other locations, and for that reason the results in actual propagation of game fishes by the Board for the first season of its work has not been what it was hoped it might be when first begun. Lacking a plant where wild fish could be captured in any great numbers for spawning and not deeming it wise to start the building of an extensive station for the maintenance of a large school of brood fish as long as there seemed a reasonable prospect of obtaining the site at Spring Creek, it has been forced to the makeshift of getting eggs for propagation work wherever they could be obtained, either by purchasing them from game fish stations in other states or by capturing the wild fish in limited numbers wherever

possible. By these methods there have been produced game fish as shown by the following tabulated statement:

Station	Steelhead	Rainbow	Eastern Brook	Black Spotted	Total
Tillamook	3,767,000	.....	.....	4,150	3,771,150
Yaquina	14,000	.....	.....	131,100	145,100
Olive Lake	.....	243,500	.....	.....	243,500
Strawberry Lake	.....	32,500	.....	202,000	234,500
Salmon River	493,000	.....	.....	.....	493,000
McKenzie	.....	195,465	.....	.....	195,465
U. S. Bureau of Fisheries	.....	370,770	.....	.....	370,770
Colorado	.....	103,600	.....	.....	103,600
Rhode Island	.....	.....	1,000,000	.....	1,000,000
Yellowstone Park	.....	.....	.....	625,000	625,000
Montana	.....	306,000*	.....	.....	306,000
	4,274,000	1,251,835	1,000,000	962,250	7,488,085

*Eggs lost en route to Bonneville. No fry resulting therefrom.

The liberation of game-fish fry into the waters of the streams and lakes of the state has been under way during the summer of 1912. By the end of the season all the fry reared will have been released in as equitable a manner as possible with the means at our command.

One special feature in connection with the releasing of the trout fry worthy of mentioning is a contract made with Mr. S. S. Mohler, of Oregon City, who is familiar with the lakes of the Cascade Mountain region, to place in 75 or 100 of the lakes not now containing game fish in the neighborhood of 100,000 or 125,000 trout fry in the hope that these fish would breed naturally and ultimately stock the waters into which they were placed. For this purpose, this season, the eastern brook trout has been used. The contractor has used a train of pack animals for carrying the young fish beyond the limits of railway transportation. The contract price for this work was $1,500.00.

Following the example of its predecessors, the Board has directed the seining out of the sloughs and empounded

leads of water along the lower Williamette and Columbia Rivers to clear them of useful fishes before these places dry up, with the lowering of the levels of the main streams, thus saving from waste large numbers of valuable fish that would otherwise die and be lost. The species thus conserved have been mostly bass, crappies and sunfish; all non-native fishes but nevertheless abundant in the waters into which they have been planted. The fish thus saved from destruction have been carried and released into waters where they may be free and many of them into ponds and reservoirs well adapted to their existence but not previously inhabited by any useful fish.

An active campaign has been instituted over the whole state for the enforcement of the law which requires that all obstructions in streams inhabited by migratory fish be provided with efficient fishways to enable the fish to pass up and down past the obstructions. Conditions in this regard are still far from satisfactory but much improvement has been brought about and it is the hope of the Board that in time every dam or natural fall will be provided with a fishway as nearly perfect as it is possible to have it.

The Board has given a great deal of consideration to the subject of irrigation ditches and canals and other forms of diverted stream channels, in their relation to fish life and fishing interests. Much waste of valuable fish is caused by the swimming down the course of these channels by all classes of fishes, but particularly young fry, and their ultimate destruction when they finally strand where the water spreads out over the land which it irrigates. The law, as it now stands in the statute, requires the screening of the channels of all diversions of natural streams to prevent the entrance of all kinds of fishes. It is found, however, that in practice any screen with meshes fine enough to turn small fry will soon clog with drift and silt and stop the flow of water into the ditch. The result is that it is utterly impossible to enforce the real spirit of the law. Many inventions have been made of contrivances, intended to screen

ditches satisfactorily, which will be self-cleaning. The Board has examined a number of these but has not found any that appear entirely satisfactory. Most of them are efficient from the fish side of the question, but there are objections to all of them in their practicability as to installation and maintenance. Three different styles of automatic screens have been approved and recommended as satisfactory, in case they are installed and maintained, but none has been formally adopted and its use made compulsory. This is one of the most perplexing subjects with which the Board has had to deal and its solution in a manner which shall be equitable to both sides of the controversy, is one of the most greatly hoped for results which has come under our consideration.

The 1911 session of the legislature enacted a law which stops entirely the shooting of introduced pheasants for two years. The belief of the framers of this law, and of the Board also, is that by thus prohibiting the killing for a few years of these fine game birds, they will increase to such numbers that an open season may again be declared.

In order to help the natural breeding of game birds, particularly several species of introduced pheasants, the Board, early in its history gave consideration to the subject of the breeding in captivity and subsequent liberation of large numbers of game birds. In the fall of 1911, a contract was made with Gene M. Simpson for the leasing of his game farm in Benton county to the state, to be operated by the owner as a State Game Farm under the direction of the State Game Warden and the Board. Mr. Simpson's stock of birds was bought. His farm was leased and his services were contracted for for a term of three years. This game-breeding plant is now in full operation and will turn out this season 2,000 Chinese Pheasants, 200 Reeves Pheasants, 150 Golden Pheasants and 60 Silver Pheasants. Besides the work on the different species as indicated, experimental work is being conducted on native birds and other foreign kinds with a view of ascertaining the ability to breed in

captivity many species and thus stimulate the production, by artificial aid, of many, if not all, the valuable game birds. The plans of the Board in connection with the liberation of game birds reared at the game farm is to liberate them in localities where they are now least abundant and where they can be assured of as good protection as possible against unlawful destruction. For this purpose, tracts are being secured in as many places as possible, of as large an area as practicable, which are being designated, marked and posted as game refuges. The game inhabitants of these tracts will be protected as carefully as possible with the idea that they will there increase and gradually spread beyond the boundaries of the protected area and ultimately stock the surrounding country to the benefit of the sportsman. Thirty-six contracts for the establishment of game refuge tracts have been made throughout the state, covering 12,402 acres, each tract having an area from 500 to 3,000 acres. Six other contracts are under consideration for a game refuge tract in Wallowa County, covering an area of approximately 1,500 acres.

Under the direction of the Board, the State Game Warden has entirely reorganized the Deputy Warden service throughout the state. The corps of deputies is divided into three classes, as follows: District Deputies, Regular Deputies and Special Deputies. The first named class are composed of the most active and efficient men and they are charged with supervision and, in some measure, control over the other Deputies within certain prescribed districts, in addition to the duties usually allotted to Deputy Game Wardens. These District Officers are paid a somewhat better salary than the regular Deputies, depending on the length of service and efficiency; their compensation averaging about $100.00 per month, besides the necessary traveling expenses. The Regular Deputies are paid a fixed salary in addition to actual traveling expenses, and are under the immediate direction of the District Deputies and of the State Game Warden. The Special Deputies are volunteer

citizens, who are commissioned and supplied with a badge of authority but are not paid any regular compensation other than expense money on special cases. The compensation of the Regular Deputies varies with conditions, length of service and efficiency, but amounts to an average of about $70.00 per month besides necessary expenses.

The protection of the native so-called "big game" is under the immediate care of the corps of Deputy Game Wardens. No effort is being made by the Board to breed game mammals in captivity. One experiment, in conjunction with the Bureau of Biological Survey of the Federal Government, is being conducted with a view of determining the practicability of successfully transplanting wild wapiti or elk from one part of the nation to another. During the past winter, a herd of fifteen elk was accepted from the Federal authorities at St. Anthony, Idaho, which had been taken from the region in Wyoming known as Jackson's Hole, and was transported with considerable difficulty to the northeastern part of the state, where they were liberated, or rather placed in an enclosed area within a National Forest Reserve, the use of which was donated for this purpose by the National Forestry Service. It is too early to give results on this experiment, but a fair percentage of the animals survived the very trying ordeal of the long journey by rail, wagon and sled, and are now confined within the 2,500 acre pasture which is set aside for their grazing. Within the next year it will be known whether they will thrive and increase sufficiently to justify this and further efforts of the same nature.

The stock of "big game" animals of this state has been rapidly diminishing as the population has increased and civilization has spread over areas formerly held by primitive conditions. With a few exceptions, deer are more plentiful today in sections of certain eastern states than they are in the mountainous districts of Oregon. The Board believes that this condition is due to a number of causes, the chief of which is lax enforcement of poorly framed protective

laws combined with the raids of predatory animals; and is unanimous in the belief that, if the illegal killing of deer, particularly of does, can be stopped, and the wolves, cougars, and wild cats exterminated, deer will naturally increase within the boundaries of Oregon, even with a reasonable open season annually for hunting them under proper restrictions. Towards the remedying of the first cause, the State Game Warden is putting forth his best endeavors. The state is so large, however, and the sentiment of the people towards game protection has become so perverted, that even with his best efforts far from a satisfactory state of affairs can be brought about. Under the direction of the Board, the State Game Warden is, through his deputies, conducting a campaign of education in an effort to create a sentiment favorable to game and bird protection and in opposition to what seems to be the prevailing sentiment amongst the populace.

For the elimination of the second cause, the Board looks to the next session of the legislature for relief. All authorities agree that predatory animals, particularly cougars and wolves, kill more deer annually in Oregon, by far, than all classes of men. The commissioners are firm in the belief that the state bounty for the killing of these animals should be made sufficiently large to induce systematic hunting of them to the point where they will become rare, if not extinct. It is argued that, if these bounties be made thus large, it will be an economy in the end, for, while it might cost a considerable sum at the beginning, it would be only a short time until there would be few, if any, animals left on which to pay bounties.

One of the duties laid down for the State Board of Fish and Game Commissioners by the Governor has been the suggestion to the next legislature of revisions and improvements in the laws of the state which relate to fish and game. The Governor has indicated in public utterances that this is expected of the Board; so, in obedience to that suggestion, this body is now actively engaged in the for-

mulation of an entirely new code of fish and game laws, which it will present for the consideration of the 1913 session of the legislature with a view to its substitution for all existing laws now in force.

As indicated in the beginning of this report, the members of the State Board of Fish and Game Commissioners receive only nominal money compensation. Their salaries are fixed at five dollars each per day while actually in session, with a proviso that the annual compensation of each member shall not exceed one hundred dollars. The citizens who have undertaken this work cannot, therefore, be suspected of selfish motives. They are indeed actuated solely by a hope that they may by their efforts help to improve generally the conditions which relate to the game birds and mammals of the state and also the fishing, either for profit or sport, within the waters of the state. They know that the conservation of the game resources of the state may be made a mighty asset. The commercial fishing interest of the state has been, and still is, about the third in magnitude of all its productive industries. Faulty laws and inefficient enforcement of the laws have decreased this industry and threatened it with extinction. The Board hopes by its efforts to check the deterioration of this industry and, by stimulating artificial propagation, improve the supply of valuable food fishes naturally inhabiting the waters of the state.

Fishing for sport has long been recognized as one of the most pleasant forms of out-of-door recreation indulged in by mankind. The angling in the waters of Oregon has long been celebrated for its excellence. But the encroachments of civilization, combined with the lax enforcement of faulty laws, has caused a rapid deterioration in the angling conditions, and the devotees of angling were beginning to look forward to a time not far distant when the catching of real wild game fish within the boundaries of this state would be a thing of the past. The object and hope of the Board towards the sport of angling is that by vigorous stim-

ulation of artificial propagation of game fishes, together with better and more honestly enforced protective laws, this sport may be improved and perpetuated and handed down to posterity even better than we found it in our boyhood.

DISCUSSION

Comment by Mr. Cranston during the reading of the paper: I have said that no stream after it has been obstructed will afford as good a passage for fish as before, and that all we can hope to do in overcoming the obstruction is to make as good a fishway as we can. But it is almost impossible that a stream once obstructed can be provided with a fishway that will be as good as if that obstruction had not been placed there.

Comment during the reading of the paper: The timber and lumber interests of Oregon are counted the first in the state in magnitude, agricultural second, and the commercial fishing interests third; so you can see that the fisheries are an important subject, and the judicious handling of them and the judicious enforcement of the laws regulating them are not boys' play in any way.

Further comment: I did not realize until I came here and heard something of the celebrity of Colorado, what a fine state we have in Oregon; and I want to say nothing derogatory to the people here. It opened my eyes to what we have at home. The fact that we have not advertised our angling resources is the only reason why we are not just as celebrated in that regard as some our sister states. It is not generally known and not widely advertised, but it is true that several streams in Oregon are probably as good as any in the world; and well-informed anglers come from the four corners of the world to angle in some of our streams, notably the Rogue, Williamson, Spring Creek and the Clackamas. The last-named stream was made celebrated through an article by Rudyard Kipling, who fished for steelheads there on the occasion of his first visit to Portland.

Mr. S. E. Land, Colorado: I am very much interested in the report of Mr. Cranston and especially in regard to fishways. We have had the same experience with our fishways in Colorado; but we have found that in a fashion they do allow the fish to ascend the river; and, moreover, the law is passed so that no man can fish within 200 feet of a fishway in this state during the season when the fish are running and spawning. That helps protect them. Otherwise there are only a few streams where they have been found to be of any advantage here in Colorado. But the law is insistent that they shall be placed on every obstruction in the water.

MR. CRANSTON: It might interest those present to know that we also have a law forbidding fishing within a limited distance of the outflow of the fishways.

PRESIDENT FULLERTON: Minnesota has it limited to 400 feet.

MR. CRANSTON: Our law stops angling within 200 feet and commercial fishing within 600 feet.

THE WHITEFISH

Minimum Size Limits. The Scales vs. the Yard Stick

By C. H. Wilson

The purpose of this paper is to obtain from the American Fisheries Society the endorsement of the best and safest method in the measurement of the whitefish of the Great Lakes that will give said fish at least one opportunity to reproduce its kind before being taken for the market or the table; such method to show both weight and length of fish to be taken; such endorsement to carry with it a recommendation to all states and provinces interested urging the adoption of the same. In this discussion of the whitefish the word is used as defined in the international treaty between the United States Government and Great Britain concerning fisheries in waters contiguous to the United States and the Dominion of Canada, which is as follows: "This term includes the Lake Superior or Labrador whitefish (Coregonus clupeiformis) and Lake Erie whitefish (Coregonus albus). It does not include the Menominee whitefish, called the Round Fish or Pilot Fish (Coregonus quadrilateralis)."

It is the firm belief of the writer that regulation by a minimum size limit of this fish is the most important of all present forms of protection to insure a generous supply of eggs for hatchery purposes, thereby largely increasing the present supply for commercial purposes. It is to be regretted that in all the valuable and helpful discussion of whitefish by our Society comparatively little in detail has been said about size limits. Certainly not as far as minimum size limits are concerned. In all instructive papers written in recent years on this valuable food fish little is found regarding protective size limits that would justify state or province in its acceptance of them in the formulation of regulations having in view a maximum amount of protec-

tion with a minimum amount of expense or hardship to the commercial fishery interests, and as before stated it is a source of regret for it seems to be the weak point in the armor of protection that has been thrown around this species through the efforts of the Society, its members and friends. This weakness in our armor has been discovered by the fishery interests, who prefer temporary advantage rather than permanent profits and successful efforts have already been made to break down former legislation which gave a fair degree of protection. Up to 1912, every state and province interested in the Great Lakes, save Pennsylvania, gave a minimum size limit of protection to the whitefish. Ohio's law is one and three-fourths pound in the round; Minnesota's, two and one-half pounds in the round, while the other states' and the Dominion's regulation is two pounds. This latter weight of a minimum size of two pounds has the endorsement of the heads of fisheries departments of both the United States and the Dominion of Canada, has the recommendation of the International Commission and was embodied in the treaty on international control of contiguous waters of the United States and Canada. When we of the states bordering upon the Great Lakes consider that, for twenty or more years, the United States Bureau of Fisheries has planted annually in those waters upwards of 200,000,000 of whitefish fry, the question is asked why these states should not legislate in harmony with the wishes of the Bureau of Fisheries, which are, as expressed by the Commissioner, that a uniform law of two pounds in the round for whitefish would be beneficial. Let us go back a moment to Pennsylvania. Notwithstanding that state has been accorded for years the privilege of taking and has taken millions of whitefish eggs from Canadian waters, and has received annually from the United States Bureau more whitefish eggs than any other state, some years more than all other states combined, one looks in vain in the Pennsylvania digest of fishery laws for even the word "whitefish,"

there being no direct protection by minimum size limit or close season during spawning season, the size of mesh of nets permitted in Lake Erie being the smallest known to be used for commercial fishing for fish other than trout in that lake.

Let us now turn to the Empire state, producing as it does only about ten per cent of the fish consumed within its borders, relying upon state and province for the balance of its requirements. Previous to 1909 there had been practically no restrictive legislation regarding size of gill nets to be used, close season or minimum size limit—an open season with unrestricted market. In 1909 legislation was secured in harmony with other states and provinces—close season during spawning season and minimum size limit of two pounds in the round. The old regulation regarding the size of mesh of gill nets to be used was not disturbed by statutory enactment, power being conferred with the commissioner to file with the Secretary of State an order increasing the size of mesh of nets to be used. This, however, was not done until two fishing seasons were passed, the order when filed not taking effect until January 1, 1911. One can readily see that commercial fishermen objected to a law that previous to 1911 permitted sale of licenses to use nets of such small mesh that the size limit of fish was violated; however, it must be said that the Lake Ontario fishermen endorsed the regulation and the Lake Erie fishermen said they did not wish to take immature fish under two pounds in weight. In 1912, there was a codification of the fish and game laws of the state; many hearings were given by the able committee on codification, the friends of the whitefish contending that the former regulation was fairly satisfactory to the people and not unjust to the commercial fishermen, confident that when a sufficient time had elapsed to show results, these regulations, ably assisted as we have been by state and national hatcheries would prove of great advantage in the rehabilitation of the whitefish industry in

the state, asked for its retention in the new law, which was granted. The codification committee, its work well performed, presented a printed report to the conservation commission now having charge of the fish and game matters of the state. When this report was presented by the commission to the legislature for the purpose of legislative enactment it was discovered that politics, which has been so ably defined by a former president of the society, as a disease, had had its day in court, and that the cold-storage men, fish dealers, and their friends had gotten under the armor of the system of protection of the whitefish by the way of the size limit, for this bill displaced the former regulation and adopted a new method of measurement by making a minimum size limit of 12 inches, with no close season for whitefish for Lakes Erie or Ontario. This is the present regulation, and we are to consider this method of ascertaining size of maturity upon the precedent established that of a 12-inch size. The changing of the manner of determining the size of whitefish to be taken from a weight to a measure of length is indefensible. As is well known the common method of ascertaining size of the mature whitefish is a standard one endorsed by the various heads of fish and game departments of all states and provinces except as above stated. No state or province, the United States Bureau of Fisheries, or the fish culturists use any but a weight system of measurement, and the only records of importance to be found where the inch method has been used at all is in the handling of given specimens for purposes of scientific study and identification of species, none of which harmonize the 12-inch idea of protection with that of two pounds in the round. Further, in states and provinces outside of New York, which now assist in supplying our demands for the fish, the fishermen and the dealer is subjected to expense and inconvenience, entirely unnecessary, and places upon fish and game departments, who ship fish out of their own jurisdictions, the responsibility of legislating and enforcing regulations in har-

mony with New York statutes to protect their own interests, and in the last analysis provides a way of weakening the conservation of a once most valuable food asset. Under the second head of objections to change of method of measurements of whitefish, particularly of the 12-inch regulation, as embodied in the fish and game law of New York, our contention is that for the purposes of fish culture or propagating or increasing its supply such 12-inch fish would have no value, although the contention is made that a 12-inch fish might possibly spawn. This is not a protective measure, but a license to exterminate. Furthermore, as before stated, this proposed change of method of measurement of this fish has never been used by any state or province; neither is it recommended by any one as a safe or practical method of determining the proper size of a mature fish; neither has it the endorsement of one single fish culturist, having had or now having practical experience in the propagation of this species, either in state, national or provincial governments bordering on the Great Lakes; and the conclusion of many of these practical men, with whom the writer has had personal correspondence on this subject, is perhaps best stated by one of the superintendents of a United States hatchery, showing a large annual output of whitefish fry, who writes: "No one would think for a moment of taking a 12-inch whitefish for hatchery purposes." Thus are the statements of those who favored and proposed this regulation disproved. So also is the further statement that a 12-inch whitefish would weigh from one and three-quarters to two pounds disproved by actual specimens from Lake Erie, produced at the hearings before the Senate and Assembly committees on fish and game. Such exhibits show, as do governmental reports of these fish taken for scientific purposes, the utter fallacy of both contentions. The following are the measures and weights of fish shown in Albany, coupled with a fairly selected list from government reports, to which allusion has been made. Of the specimens of Lake Erie white-

fish, shown at Albany, the smaller measured fifteen and one-quarter inches, weight one pound and nine ounces, while the larger measured sixteen and a quarter inches, weighing one pound, twelve and a half ounces. With the customary allowance of one-eighth for the shrinkage by evisceration, the smaller fish would weigh one pound twelve ounces, the larger one pound fifteen and a half ounces plus. The latter fish presumably was, when taken from the water, a fish of proper size to be taken under the law.

List of specimens in Washington, as shown by reports:

Name of Lake	Length	Pounds
Lake of Woods	21 in.	2½
Champlain	15 in.	1¼
Champlain	20 in.	2¼
Michigan	11⅝ in.	7 oz.
Erie	20⅜ in.	3¼
Michigan	14¼ in.	12 oz.
Michigan	14¼ in.	14 oz.

Herrings

Herrings from Lake Michigan, 13½ in. weighing 10 oz.; 13¼ in., weighing 13 oz.; 13½ in., 14 oz.

From Lake Ontario—12 in., 8 oz.; 14 in., 16 oz.

Lake Huron—11 in., 5 oz.

That the first appearance upon the spawning beds of the whitefish, according to Dr. Jordan, is not the best evidence of its maturity is strengthened by Government reports of females taken in Lakes Michigan and Huron from 1904 to 1911, inclusive. Females taken, 39,789; females stripped, 29,485; males taken, 75,821. There is no record of number of males treated or handled. Presumably not all rejected females were immature; however it is fair to assume that a large percentage were immature, thereby strengthening the opinion of many fish culturists that the statement of the late Frank N. Clark, that a mature fish should weigh two

and a half pounds is a correct one. This same weight is the law for the State of Minnesota. Another very serious objection to the 12-inch provision is that furnished by a prominent member of the Society, viz.: that "as a commercial commodity such fish has not reached 50% of its potential value, and the taking of such fish must be a financial injury to the commercial fishermen. Furthermore, it is idle to presume that, under this system, no whitefish will be sold which, at the time of capture, was not of required length, said fish having undergone the inevitable change incident to transfer to market and cold storage operations. How, may I ask, will the sale of whitefish as herring (a less valuable product of the Great Lakes), under a 12-inch law, be prevented? Already this phase of commercial dealing has been a source of trouble in some states, it being almost impossible for the average man to distinguish between the two fish.

Under present conditions it is practically impossible for any state having a large population to furnish from the inside all food fish demanded by the people; and it should be easy to conclude that wisdom would dictate the necessity of not only protecting and conserving its own meagre supply, but throw around the incoming supply of fish the same protection accorded by the state or province from which they come that we with them may give stability to their own regulations and so continue their supply as well as our own.

The State of Pennsylvania does not in any way do this. and, of course, in New York, this is not what is being done under the 12-inch law. And when we remember that about one-tenth of the population of the United States are in New York, and that 90% of her supply of fish must come from the outside, do you wonder that we are disturbed with thoughts for the poor and those who for conscience's sake must purchase fish for food, and so come to you for assistance.

It has been stated that this 12-inch law on whitefish in New York is a license to exterminate.—Let me add, not

only our own, but your own, and Canada's own, supply of food fish of this variety, for, if it has not already, it surely will become the dumping ground of the immature and illegally taken fish of your state and province, to the disgrace of the state and the jeopardy of the food fish supply of the continent; and this condition exists today, gentlemen, as a result of the insistence of politicians and the paid efforts of attorneys for the fish trust, cold-storage men and dealers, whose principles of doing business recognizes no delay in the taking of profits and brook no interference with their methods of conduct in business. Let us not deceive ourselves by believing that one point gained by these men opposed to the proper protection of fish life, as exhibited by legislative action in Pennsylvania and New York, will satisfy them, for it is here stoutly maintained that such successful breaking down of protective legislation will prove an encouragement to further encroachment upon laws protecting other varieties and in other states, thereby proving a menace to all legislation protecting fish life.

This is not all. Look at figures a moment. The Census Bureau at Washington, in 1909 report, states the value of whitefish fisheries for that year to have been $524,650; while the United States in 1910, on that portion of the 73,000,000 pounds of fish sent to us from Canada that year, paid in duties alone $463,663. These latter figures were taken from the "Reciprocity Report," which shows a total value of food fish and fish products for that year from Canada alone of $4,920,236. Expensive, is it not? Duties paid for year 1910 almost equal in value the total catch of whitefish in United States for 1909. Neither is this all. The worst is in prospect, and will be given as briefly as possible. The Canadian people now chafe under the situation that has arisen through the organization of an American monopoly to control the Canadian Great Lakes and other fisheries, the operation of which, in order to supply the insatiable demands of the great cities of the United States, deprive the Canadian people, and to their great injury, of

the carefully estimated amount of 95% of their catch of food fish. Already the Georgian Bay Fishery Commission, alarmed at the decrease in the annual catch of whitefish, have recommended to the Dominion Government a measure which would prohibit the export of this species. This halfway method does not, however, meet with the views of the Ontario Game and Fisheries Commission, but rather that the power of the trust should be broken and that the requirement of all classes of her citizens should first be met, equal attention being paid to the coarse as well as the finer varieties of fish; and, need we be surprised at their position, when we realize the fact that, immediately preceding the Lenten season, two years ago, in the United States, the fish trust advertised cold storage suckers and mullet at five cents per pound. Truly an ennobling prospect for the poor as they approach this annual period of fasting and prayer—a disgrace on any nation. Ontario doubts not that prohibition of exports in a modified form would be a powerful factor in remedying the deplorable condition both of her fisheries and her fish market. Expression of their views is found in the conclusion of the Commission under general recommendations in regard to the Great Lakes commercial fisheries, section 8, and is as follows: "That steps be taken to have the export of whitefish and lake trout prohibited for a term of at least five years by a Dominion regulation, and that, meanwhile, the further export of these fishes be prevented by the endorsation of licenses issued to the fishermen and fish buyers, with a provision to that effect." In addition to the above, the Commission deals quite extensively with the question of an export duty on both coarse and fine commercial fishes. While both Dominion and Provincial Fishery Departments are showing great interest in these matters, there appears another powerful factor in the matter. Reference is made to the Commission of Conservation of Canada. In one of its reprints of report of 1911, quoting from the report of the Manitoba Commission regarding whitefish size limits, recommends closing of summer fishing at least

in Lake Winnipeg, such close season to continue until evidence forthcomes that the fishing resources of waters named had reached their former plentitude—a gradual increase in size of mesh of nets to be used and that, in view of the fact, brought to the attention of the Commission that, during the winter of 1911, several carloads of whitefish, caught in the waters at the north end of Lake Manitoba, were found by the buyers after purchase to be fish of such small average size that it was necessary to hold them back until catches of larger sized fish could be secured to mix with them before exporting the whole. In this way alone was it possible to raise the average of the shipment to a marketable size. Continuing, this report states that they are aware of the fact that a large quantity of whitefish, under the legal size of two pounds in the round, the results of the previous years 1909-10, are still held in storage in Winnipeg. Now, in view of these facts, the Commission concludes as follows: "We are convinced that it will be absolutely necessary to require the use of nets of not less than five and a quarter inch extension measure, if such a destruction of small whitefish as that we refer to is found to continue." There can be for us but one logical conclusion regarding the above facts, viz.: That any state that permits the sale of these immature fish becomes the dumping ground of the illegally taken fish of our neighbors, and, if from Canada, you may rest assured of their treating in like manner all illegal and immature fish from your own state. When, "under present conditions Canadians, when buying fish, actually pay a profit to four different persons, viz.: First, the fisherman; second, the wholesale fish dealer; third, the jobber or middleman; fourth, the retail fish dealer," is it to be wondered at that this Conservation Commission of Canada, after investigation, declare new regulations desirable and propose a list of recommendations drastic in character that will save to Canada her great fishery interests? If these two methods of determining the size of mature fish for purposes of legislation are to be used, it becomes necessary that there be estab-

lished a standard, a harmonizing of pound and inch methods, quite as necessary as the standardizing of sizes of output of hatchery and certainly of more far reaching importance. In the consideration of the question of determining just how long in inches a whitefish must measure to harmonize with the present standard of practically two pounds to the round, it may be stated that one fish culturist of forty years' experience writes as follows: "A twelve inch whitefish will not on the average weigh one and a half pounds, and in some waters not over one and a quarter pounds." The Hon. John C. Speaks, chief warden, Ohio Fish and Game Commission, writes in this connection that, in his opinion, it would be an excellent idea to have a conference in Washington or at some other convenient point, and endeavor to decide upon some policy or plan which will insure co-operation, while another commissioner has offered to make weights and measurements of whitefish during the coming season's operation and report results. The department at Washington will also be requested to ask fish culturists operating whitefish hatcheries to take weights and measurements of whitefish taken during the coming season, having in mind the solution of these questions. The present fish culturist of New York, in his book on "Food and Game Fishes of the State," 1903, page 313, speaking of the whitefish, makes the following statement: "In Lake Erie, in 1885, the average weight was between two and three pounds. The length of adults will average twenty inches." After much thought and observation, it is the personal opinion of the writer that, for purposes of legislation, the inch measurement of a two pound whitefish should be sixteen inches or more. In what has been said about advocating size limits in detail, it is to be understood that the larger part of the credit of establishing such size limits rests upon this Society and the many fish culturists and heads of departments who for years have advocated this measure of protection.

With personal acknowledgments to the many state commissioners, to provincial departments of fisheries, to the

commissioners at Washington and at Ottawa, to the many eminent fish culturists of state and national departments, to the Commission of Manitoba, and the Conservation Commission of Canada, for their valuable reports, to your great big member, Kelly Evans, of the Ontario Commission, to the contrary winds that have only served to stimulate us to labor in the interests of the poor who suffer because of lack of food, and to the American Fisheries Society, its members and friends, with acknowledgments to all for assistance given in the production of this paper, it is concluded with the sentiment of Evans that no great stretch of imagination is required for us to see and conclude that the whole question of the commercial fisheries, not only of the Great Lakes bordering upon the two countries, but all waters producing marketable fish, is not only of national, but of international importance, and that, if we would conserve that which is of vital importance to the food supply of a continent, we must have protective size limits that will afford each fish an opportunity to at least once produce its kind before capture; and you are urged, after deliberation, to write into your reports plainly the best methods required to produce such results, and to write across the heavens above this continent such ruling that he who runs may read, that states and provinces may have no excuse for lack of harmony in the laws of protection and conservation, and that justice and fair dealing may prevail.

FISHWAYS FOR THE RANK AND FILE

By W. O. Buck

In his clear and complete article on fishways, published in the Report of the United States Fish Commission, Part II, for 1872-3, Mr. Atkins remarks that it had been deemed expedient to provide fishways for salmon, shad and alewives only, that is, for fishes specially classed as migratory because they run from the sea into streams to spawn. It long had been realized that obstructing the passage of these fish up the streams must be fatal to the fisheries, and even now when artificial propagation has advocates so enthusiastic as to claim that it is the proper method, no one will go so far as deliberately to throw away the aid which fish bring to the good cause when allowed to spawn naturally.

The recognized American authorities on the subject, Atkins, McDonald, and Von Bayer, after carefully reviewing all the various fishway designs and approving several of them, conclude by each proposing a new plan. This argues that preceding ones were not entirely satisfactory.

After mulling over the subject a few years, the writer followed these distinguished examples and planned a modified form of fishway for the dam at Grand Lake Stream, Maine, and procured the consent of the powers that were to have it built. Some members of the Society will recall a description of this fishway, presented some years since and accompanied by a promise to report later as to its efficiency. Observation of the fishway for a year or more failed to reveal the passage of salmon through it, and Mr. Story, in charge of fish cultural work at that point for the past three years, writes: "In regard to the fishway, I doubt if a salmon ever went through it. My idea is probably worthless, but I think the great fault is lack of inducement —remedy, more water, also place fishway near greatest current. I think the fishway should vent all the water needed in low water. We know that fish could go up this fishway, if

they wanted to; we also know they will leave the fishway and go to the open gate, even though they cannot get up, which goes to prove that in order to make fish do as we want them to we must make conditions conform with their instinct."

An excellent and expensive fishway at Bangor, on the Penobscot, was at one time examined by the State Commissioners and found to contain salmon in nearly or quite all its pools, and salmon are found in the river above the dam. This seems to argue the efficiency of the fishway. Nevertheless the pool below the dam is an excellent one for the fly-fisherman to exercise his art and the fish do so abound there that good catches are made in spite of the fact that salmon do not feed in fresh water and it therefore becomes necessary to attach the hook to some other portion of their anatomy than the appetite. Moreover, this is a comparatively low dam and the water-level below is determined by the tide, which rises and falls some 10 feet. At high tide and especially at a high spring tide, or on occasion of an easterly storm when the water is driven into Penobscot Bay, it is probable that salmon can pass the dam by way of the log sluice, and the assumption (*quite gratuitous*) that this is the road by which they go would explain their presence above the dam and also their waiting at its foot.

Of the three classes of fishes above mentioned, whose tastes have been considered in the planning of fishways, salmon are doubtlessly best able to meet and overcome difficulties and we have heard their verdict in regard to two of the plans proposed. In offering a new one, the writer justifies himself not so much on this verdict regarding the older plans as upon certain observed facts, which may be set forth briefly.

1. In handlng young fish in troughs it is usual to set the trough with some slant so that in cleaning the bottom the sediment can easily be brushed toward the foot. This operation is helped by raising the dam or removing the outlet plug so that the water is drawn down until only a thin stream remains in the upper part of the trough, but the young fish

will push up in this to the intake even though they are not half submerged.

2. Similarly young salmon have been seen to crowd up on the apron of a dam to the very gate when all the gates were closed and the only flow was leakage hardly more than enough to keep the planking wet.

3. In the traps in use at Grand Lake Stream the salmon are captured on their way down from the lake to the stream, being guided by an arrangement of nets into a small enclosure. When they seek to pass out of this, their search is upstream and the only upstream egress is through a funnel-shaped opening at the bottom and only 6 inches square. Small as this is, the largest salmon in the stream always find and pass it promptly. As there are usually some in the catch weighing 7½ pounds, and a sea salmon still larger is occasionally taken, it is evident that salmon are willing to pass through a very small opening, if only it is in the right direction to meet their views.

4. This fact is still further shown by their behavior in the enclosures in which they are held during the spawning season. The barriers forming these are of fine netting held by stakes and weighted to the bottom by chains laid in a fold of the net. If there is a small gap under the upstream net, where the net does not fit the bottom closely, the fish will wriggle through, even digging under or lifting the chain if necessary.

5. On a steep sloping ledge covered with moss and slime, trout have been seen to make their way upstream in water too shallow to cover them and which was very swift. In that case they would push ahead a short distance and stop, possibly catching hold of irregularities, or more probably by resting the broad pectorals on the bottom and allowing the pressure of the current to hold them at anchor. That the current will have this effect a simple experiment will show. Put a shingle at the outlet of a sluice so that its thin end will rest on the bottom and the thick end will project below the end of the sluice. Half the length of the shingle

may thus project before it will be moved downward by the current. Now raise the thin end a trifle and see how quickly the current will have the mastery.

The suggestions for a fishway, which it is desired to base on these observations, are: 1. The bottom of the fishway should be uninterrupted. A swift current is no great obstacle, if only the fish have access at all times to the bottom. Nor is a smooth slippery bottom objectionable but rather the reverse. No argument against this view can be based on the fact that the bottom of most streams is irregular, for in the roughest streams everything is covered with slimy, slippery growths.

2. There should be a continuous smooth flow along the bottom. To secure this it is proposed to build a straight steep sluice and insert partitions in this sluice leaving openings under each partition all the same height and across the entire width of the fishway. It is evident that the total fall will be divided into as many steps as there are partitions and the fluctuations of level above or below the dam will also be so divided and the flow will never be too small nor too great, provided the right number of partitions has been inserted.

This mode of reducing the head and thereby the velocity of the current is that of the Hockin fishway figured by Mr. Von Bayer (Bulletin of the Bureau of Fisheries, Vol. 28, 1908) and at certain stages of water might be that of the Cail and Von Bayer fishways also. The plan proposed differs radically from all of these, however, in three points: 1. In having the bottom a continuous slope without steps. 2. In having the openings at the bottom and under the partitions rather than through them, and: 3. In the extension of the openings across the whole width of the fishway, thus avoiding horizontal eddies. It is not claimed that there will be no eddying but it is believed that the eddies will be vertical and mostly above the bottom and that there will be a current along the bottom constantly in one direction, although doubtless varying in velocity at different points,

being slower between the partitions than under them. The build of fishes enables them to head upstream with less effort than in any other direction, or just as a weather-vane points to windward. Their whole energy may, therefore, be applied to stemming the current and every move will set them forward in the right direction. Prof. Elias Loomis once said to his class: "If you wish to know how anything in nature will behave, you must experiment; you can't reason it out beforehand." In suggesting this plan for a fishway the writer wishes to admit that the fishes still hold the same veto power which they have been exercising at their own sweet wills in regard to all previous plans. That is, although the plan is based on observed habits of fish, as well as hydraulic principles, still it must be admitted that no fishway has yet been built on this plan and submitted to the fish for approval. For the benefit of the daring innovator who may venture to build one, a few further suggestions are offered.

1. Have the openings at the upper and lower ends of the fishway as low as practicable, that is, not only on the bottom of the fishway but on the bottom of the stream, or as near it as may be practicable.

2. Where the opening is above the bottom of the stream, extend the bottom of the fishway beyond its sides up or down stream, as the case may be, so that fish may pass to and from the apron thus provided in water less swift than that of the fishway itself.

3. Where practicable, build the fishway above the dam. This last because there are almost sure to be leaks, and a leak into the fishway through a crack in side or bottom is far less dangerous than a leak out of it. This is not mere theory, but is based on the observed fact that numbers of salmon have been found caught and killed by being held by pressure of water at a crack in the planking above a dam.

In conclusion, it may not be amiss to refer briefly to the points in which existing fishways seem to the writer to *come short.*

1. Fishways of the older styles which have the advantage of an inclined plane for the bottom have this either vitiated by partitions producing steps or offset by the disadvantage of whirling currents and eddies. The Grand Lake Stream fishway is faulty in both respects.

2. All fishways having an intake at the top are open to the further objection that flow of water through them varies greatly at different levels or stages of the lake or stream above the dam. And this variation is not limited to the flow over the top, but, as the level varies, the rate of flow through submerged openings, if any, varies also.

An effort is sometimes made to obviate this difficulty by completely enclosing the upper pool of the fishway so that there is no overflow into it even at the highest stage of water, but it is supplied through an opening submerged at all times. This is good so far as it goes, since the variation of level will be halved and in some situations halving will keep it within the limits of the powers of the fish for which it is intended. But it is clear that such an expedient would not meet conditions like those at Grand Lake Stream, where the fluctuations extend to the whole height of the dam.

Thus far we seem to have wandered from the subject announced at the start and to have been considering salmon instead of small fry. But the fact to which attention has been called as true of the ablest fish in the stream is still more true of all the rest of its inhabitants. All prefer a foothold and most of them absolutely require it. Moreover, all are in a way and in some degree migratory and all are liable to find themselves downstream of an obstruction. The migrations of salmon, shad and alewives are determined by the spawning instinct and by the search for food and suitable temperatures. These motives affect all the creatures in the stream more or less, so that it is doubtless true that differences in the migratory habits of fishes are of degree rather than of kind.

Nor can it be doubted that it is equally important to keep the stream stocked with the smaller creatures as with the

larger. It is as true in the water as out of it that the higher is absolutely dependent on the lower and the all-important problem of fish culture is the food problem. Doubtless many of the disappointments met by those who try to stock ponds and streams are due to want of attention to this point. Too little inquiry is usually made as to the amount of food in the water or the date at which it becomes available. Fish hatched prematurely and planted in water so cold that none of the food creatures are yet developed in it, or fish produced or planted in too great numbers for the food-supply of the locality must perish. These statements sound almost exactly like platitudes, but they must be repeated as long as they continue to be disregarded.

DISCUSSION

PROF. L. L. DYCHE, Kansas: I am interested in this subject of fishways, because the Kansas Legislature passed a law, influenced largely by a number of petitions sent in by citizens, compelling owners of dams and other obstructions in streams, which prevented fish from going up stream, to put in fishways. Then the matter was turned over to the Game and Fish Warden and he was told to see to it that the fishways were put in.

We immediately devised the very best fishway, for the least money possible, that we could, with the help of a number of engineers; we published an outline of it in the proceedings of this Society last year. However, the planning of a fishway on paper and publishing it in the Transactions is one thing, and building one that will actually permit fish to go up stream is another. However, we had to make a start of some kind to satisfy the demand for fishways made by people who live above the dams.

We have superintended the building of several fishways, and no two of them are alike, because we find that the dams and obstructions in streams are different, and the streams themselves differ greatly.

The chief ideas in this fishway, as you will see by examining the plan that was published in the proceedings last year, is a trough, some four or five feet wide, starting up above the dam, and running down to some pool below the dam, and having one foot elevation to five feet of run. We put in three or four of those built along the lines suggested in the plans that were published in the proceedings of this Society. As yet we have not had time to secure definite information as regards their success. If fish do not go up through them, they are of no value.

At Wichita, Kan., a modified form of this fishway was put in over or rather around a dam that was built across the little Arkansas.

Mr. Wells, City Engineer of Wichita, and myself figured out a plan of having a fishway that would start right up close to the dam, so that the water would really fall over it and on it. The fishway started close to the dam and went north until it got past the abutment; then it turned and went west behind the abutment, and reached the water several feet above the abutment. Of course a trench was dug behind the abutment, and when the fishway, which was built of steel, was finished, that part behind the abutment was covered with earth. In the building of such a fishway some of the rules for building such structures were violated. In a way it was an experiment. Mr. Wells watched this fishway last spring during May and June, as many people had grave doubts about the thing "working." The fact is that both the engineer and myself had doubts. However, Mr. Wells reported to me that the fishway was a great success. Many fish went up, especially catfish. The exact number and varieties that go up during a given length of time we hope to be able to report at some future meeting. However, the fish went up in such numbers that it was necessary to protect the end of the fishway from poachers at night. It was discovered that certain persons were stealing the fish that came up through the fishway.

C. K. CRANSTON, Oregon: What were the species?

PROFESSOR DYCHE: Many catfish, both bullheads and channel catfish and a good many scale fish, but I could not be sure of the species from the description given.

I studied the Cail fishway and others, but it costs a good deal of money to build them. The fishway we have planned is not expensive. We hope in the future to determine its efficiency for different streams and for dams of different heights.

In Arkansas City, Kan., a fishway has been built following plans published in the proceedings. It has a straight run from the river below the dam to the water above. It is on the south side of the river and passes up along the side of the abutment. This entire structure is built of cement; it is as solid as stone. I was told by fishermen that fish went up this fishway. I went to see for myself, but it was in July and about noon time. I saw no fish in the fishway. Another year may furnish some definite information, when we hope to have capable men in charge of these fishways.

MR. CRANSTON: How did you meet the difficulty of the varying height of the crest of the dam caused by these steel sheathings you described over the Wichita dam?

PROFESSOR DYCHE: The fishway was built underground, starting below the dam and passing around behind the abutment and reaching the water above the dam.

MR. CRANSTON: So that in the high stage of the stream the fish would enter the upper stream well below the surface?

PROFESSOR DYCHE: Yes. But even in low water the fish would come out a foot or more under the surface of the water.

MR. CRANSTON: Then at a very high stage would not the pressure of the water from the head be too great?

PROFESSOR DYCHE: Yes. Fish will not go up stream at all when there is such pressure. High water is a catastrophe for fish, and they do not try to do anything under such conditions except to protect themselves in more or less sheltered places.

MR. NATHAN R. BULLER, Pennsylvania: I am very much interested in this fishway proposition before the Society at the present time, and I would like to get some information in regard to fishways.

One of the nightmares of the Commissioner of Fisheries is caused by a law that compels all dams built in Pennsylvania to be provided with fishways for the fish to ascend the river. The Susquehanna River is a shad stream emptying into Chesapeake Bay. The shad ascended the river and there were fishing rights granted by the state to a great many owners of land along the shores of the river. Some years ago the Pennsylvania Water & Power Company erected a dam across the river, 65 feet high and almost a mile in length. There was placed in that dam on the Lancaster County side a Cail fishway, the entrance being at least 1,200 or 1,500 below the breast of the dam. This season I had a representative on the ground from the time the shad fishing season opens until thirty days after the close, making a daily investigation to find out whether there were any fish ascending the fishway. He would have the fishway emptied and drawn off twice a week. On four different occasions I was there myself, and we failed to find any fish ascending or coming through the fishway, with the exception of four or five German carp; and the supposition is that they were going down instead of going up. They were all pounded to pieces. But as far as the shad is concerned we are absolutely certain that not a shad ascended the river.

Now, the people living on the upper waters demand an adequate and practical fishway into that dam for the purpose of allowing the shad to ascend the river, because they claim that this dam has taken away their inherent rights.

Now, if there is anybody in the Society that knows of any model or any plan that is practical for the ascent of the shad, I would like to learn about it. The shad is probably peculiar in its manners as compared with some other fish. For instance, the shad will not leap, and they will not pass under a shadow. The only possible fishway that could be placed in that dam, of any benefit to the shad, would be one where there would be no obstruction over the top of the fishway; because if a shadow is cast across the water they will not pass under the obstruction.

The conditions in the river are deplorable. There were caught at the breast of the dam this season in round numbers about 40,000 shad. The barrier was there and that was as far as they could go. Besides

that I have found there on different occasions millions of eels, 3 to 4 inches in length; and millions of them dying on account of the barrier being placed there; and if it is possible to do so I would like to learn of some model or plan of a fishway for that dam that would allow at least the eels to ascend the river.

PROFESSOR DYCHE: My observations are confined to the kind of fish we have, such as catfish, bass, German carp, buffalo and suckers. I know nothing about shad or salmon, and our fishways are built for such varieties of fish as we have in Kansas. The dams we have experimented with are from 6 to 16 feet in height. It may be a more serious thing to put a successful fishway over a dam from 20 to 40 feet in height.

MR. BULLER: This dam is 65 feet high.

PROFESSOR DYCHE: That is too much of a dam for me. It might discourage the most ambitious of Kansas fish.

MR. CRANSTON: The reading of the paper and subsequent discussion has been very interesting to me, and has called to my mind a question in a problem that I had to confront on which I think possibly I may get some information here; and in order to make this question clear I will briefly state the particular instance that I have in mind.

In the Clackamas River, a tributary of the Williamette, a large power company has completed the construction of a dam, for the generation of power, which is 87 feet high. The Clackamas River is a fine trout stream and is a highway for the ascension of all the native salmon, particularly the chinook and steelhead. In compliance with the law, we insisted on the construction of an adequate fishway over this obstruction, and the company that erected it has placed there a concrete fishway which has as many pools as there are feet of rise, that is, 87 pools, a foot of rise to each pool. It starts in a deep pool at the foot and has a tortuous course passing under itself once; it is built entirely of concrete; and I am told it has added to the cost of the structure about $20,000. It has not been installed long enough so that I can report as to its actual workings; but the entrance of the last pool into the upper pond is the one point of objection which I raised to it on inspection.

Now, my question is whether the salmon, trout and other fish that inhabit this stream, of which most of you have some knowledge, would be turned back by the fact that in passing from the last pool into the upper waters of the pond, it will be necessary for the fish to pass through a gate, and through a dark tunnel that is as long as the crest of the dam is thick, some six or eight feet. The flow of the water into the fishway is regulated by a large valve operated by a hand wheel on the crest of the dam; and in case of very high water, this valve being operated to prevent the inrush of the water, would absolutely stop the passage of any fish, the flow being regulated by the manipulation of this valve. I haven't any doubt in my mind, from observing the construction of the fishway, that it is practicable in all

its course except this one place; but that point "stuck" me, and I want to ask if there is anybody here who can give me an answer based on experience as to whether that would be an insurmountable obstacle.

MR. BULLER: There is no doubt in my mind that the time is not distant when practically all the streams in the state of Pennsylvania will be a succession of dams; it will be done for the conservation of the water, and I would like to ask whether the construction of these dams will be any hindrance to such fish in the river as pickerel, pike and bass, and the other fish that inhabit our rivers.

MR. NEVIN: I claim they won't want fishways at all.

MR. BULLER: I agree with you. I never saw a fish ascend a fishway yet in a brook trout stream. In Broadhead's Lake, in Monroe County, a stream about the width of this room (about 40 feet) there was an 8-foot dam constructed in that stream quite a good many years ago; and I have seen trout by the hundreds leap that eight feet and pass on up the stream. The owner of that dam concluded that there should be a fishway placed in it. There was a Cail fishway placed in it; and I have scrutinized it at the time when the fish were ascending the creek, and I failed to see a single fish go up the fishway. As I say, I have never yet seen a fishway that the fish ascend.

But what I want to bring about is this: Knowing these conditions, I would like to see that law taken off our statute books of Pennsylvania; and what I would like to learn is whether in your opinion it would have any effect on such fish as the bass, pike, perch and catfish that are natives of our waters, and whether it would make any difference whether they had a fishway to go up or down or not?

MR. FEARING: The last thing we want a fishway for is eels. I think it is a recognized fact, and has been for ten years, that the eel brings forth its young in salt water; and it has been ascertained in Germany to a certainty that distance is nothing to an eel. There are records in Germany of eels, on their way down to salt water in the bearing season, having covered three, three and a half and four miles of absolutely dry land. The old idea of eels procreating in fresh water is exploded, and you cannot keep eels out. Most of us who are interested in the breeding of trout are looking for a way to keep eels out and have never yet discovered how to do it.

MR. BULLER: It is a well understood fact that eels will go probably where no other fish will; but we have failed to find any of them ascending the Susquehanna River through this fishway. We have found them on the rocks as high as 40 feet above the river, have found them right on the face of the rock, wherever it was damp; but this stream that is pouring over the dam is of such volume that it is impossible for them to ascend the river; and the eel in the Susquehanna River is a valuable food fish and supplies food, when it has the chance to ascend the river, to a good many thousand people. But, of course, we do not like them in our trout streams.

MR. FEARING: I would not worry about their going anywhere. They are like Mark Twain's steamboat. You will remember he said if there was a heavy dew and a man spitting tobacco juice over the bow the steamboat would go. (Laughter.)

MR. BULLER: We found them dying by the millions. They could not get up through the fishway.

MR. FEARING: But you will find millions got there just the same, and they got there over the slime and the bodies of the dead and dying.

MR. G. H. THOMSON, Colorado: This matter of fishways is especially interesting to us in the west; and we have more to contend with on these fishway propositions in our irrigating ditches than anywhere else. It is absolutely impossible for our trout to get above some of our dams; and after stocking our streams above the dam we find that the fish go down, but they cannot get back.

MR. J. Q. WARD, Kentucky: I wanted to ask if the paper read on fishways will be printed in the annual report?

PRESIDENT: Yes.

MR. WARD: And the description of the dam and fishway built by Professor Dyche in Kansas is already printed in the Transactions of last year?

PRESIDENT: Yes.

MR. WARD: How can I get one of those reports?

PRESIDENT: The Secretary will send it to you. Write to Mr. Ward T. Bower, Washington, D. C.

PROFESSOR DYCHE: Last spring one day we placed 6,000 yearling catfish in a pond that was 50 feet long and about 20 feet wide; the water was about three feet deep. That pond was connected by a 3-inch pipe that led under the ground to another pond 60 feet away. During the night the outlet to the pond got partly stopped up with moss and the water rose four inches above the usual level. About 5,900 of those catfish came up within six inches of the surface, went down into the supply pipe and took the underground passage against the current to the next pond. When we drained the second pond we discovered that 5,900 went through in one night. If they will go through a place like that it would seem that they would go through almost any opening and especially through an ordinary fishway.

MR. FEARING: You never knew a catfish to go up a fishway, did you?

PROFESSOR DYCHE: Yes, they do in the Michita fishway, both bullheads and channel catfish, and in goodly numbers.

PRESIDENT: I will give an experience that I had in Minnesota. It has been a nightmare with me. For years I have got more damning about fishways than for anything else.

MR. NEVIN: Not more than I have.

PRESIDENT: Every man that did not have fish above the dam blamed the Commissioner. My experience in fishways, had through a number of thorough tests, is that muskellunge, pike-perch, pickerel and bass will not go up a fishway to any extent. Bullheads will go up a fish-

way; and I will tell you why. I ran across a fishway on a dam after I had driven 20 miles to get a man to construct the fishway for a farm, but when I got there I found he had already constructed one. He built it out of two boxes made of planks, in which he had bored two-inch auger holes to let the fish through, and we found a bullhead in every hole, but not another fish. I know that bullheads will go up fishways because it is in them. But I believe that the fishway is vastly overrated. There is a good deal of myth connected with fishways, although it is true that trout and salmon will go up fishways.

MR. SEYMOUR BOWER, Detroit: I would like to inquire what advantage there is in fishways, anyway. I am not speaking of their use for salmon and trout, and perhaps some other kinds; but do you have any idea that you will produce any more fish in a river with a series of dams in it, where they cannot pass from one pond to another, than if they had free range? I do not believe you will have a pound more of fish with fishways. If not, what is the use of going to the expense of building them?

PRESIDENT: That is my view.

MR. BOWER: Some of the rivers in Michigan are being utilized for water power, thus creating large reservoirs and greatly increasing the water area; and there is no question but what these rivers, as a whole, are producing more pounds of fish today than they were before, whether fishways are installed or not.

MR. FEARING: I would like to state an experience in Long Island, N. Y. This whole question of fishways is becoming a serious business with breeders of trout in the natural trout streams on Long Island. In the old days there were a certain number of small fishways in all the streams on Long Island. Trout naturally will seek salt water if they can get to it. They go down to salt water, clean themselves, and in the breeding season came back. In nearly every stream emptying into Great South Bay in the old days there were fishways and the trout ran in and out. In the multiplication of fishing clubs, sporting clubs, etc., everybody is jealous of everybody elses' waters, and those fishways are then shut up. The result has been that all the trout of Long Island have gradually been dying out. I wish Dr. Bean were here, because he has studied the question very deeply; and all the best authorities in the east have come to the conclusion that the fault lies absolutely in the inbreeding of the trout; and that is all due to the fact that the trout have no means of replenishing their blood; that the same trout inbreed and inbreed, and they breed tremendously, and the young fry grow to be fingerlings and then they die, and there has been found no other explanation. At first they thought it was bad water, but it is absolutely now supposed to be from the fact that there is no new blood, and in all the places on Long Island where they breed trout now, they put in a certain amount of new blood, fish taken from Pennsylvania, Rhode Island, Connecticut and Massachusetts; and the fish are all coming back again.

In every case where a man has a small stream or a small pond, where there is no chance for the trout to come in from Great South Bay and put in new blood, they grow large. They are cannibals, as we all know, and those ponds end up with a quantity of large fish that won't rise to a fly; and they eat up all the other ones, and the young trout die.

MR. SEYMOUR BOWER: I do not question the benefit of fishways for trout. It is quite necessary for trout to be able to ascend to suitable spawning grounds, which they cannot do if there are impassible barriers. We also know that trout, where they have access to the sea and go to salt water, or brackish water, improve greatly; it seems necessary to make them strong, vigorous and healthy.

But it is quite a different proposition, these large power reservoirs in rivers, such as we have in Michigan in streams like the Muskegon River and others, where the dams have a head of from 30 to 60 feet. Each of the divisions between dams is a perfect unit, containing feeding grounds, breeding grounds, quiet water, rapid water and all the conditions essential to the production of fish at their best from the time of their birth till they are full adults. Under such conditions I see no advantage in having fishways.

MR. CRANSTON: I believe I can promote mutual interest by a few remarks and a few photographs I propose to circulate without interrupting the subsequent discussion.

We have had under consideration a fixed plan for a standard fishway proposition. But my belief is that every obstruction in a stream is a case in itself, and that it is next to impossible to establish or install any fixed standard fishway that will meet all conditions. To demonstrate the truth of that position, I have a few photographs illustrating two practical fishways in my district. I personally have inspected both of these during the time these photographs were taken, and I know they are practical fishways. The only objection is as to their capacity. We are working on them to improve them; and in one case advantage was taken entirely of natural conditions. There is practically no semblance of an artificial structure there, but just an improvement of the natural conditions to turn the flow of water through crevices and rifts in the barriers. I know that both of those fishways are practical, and still a casual observer would not probably know that either of them was artificial at all. I will pass these pictures around for examination.

PRESIDENT: I think the discussion has produced one result, and that is you cannot have any fixed rule; that every case must be governed according to locality and the kind of fish in your stream. From that standpoint the discussion has been a success.

PUBLICITY

By B. G. Merrill

Publicity is a great word.

To make a thing public is to make it known to the people, to all the people; and in America that means a great deal. For, by the knowledge and the will of the people, great things are accomplished, great ends are wrought out.

But in some manner the people must be reached; facts must be put before them, and their minds must be held to the point before they will show much interest or take part in any line of action.

As a rule, men think most about the things which lie nearest to them; but it cannot be truthfully said that the fishing interests lie nearest to any great number of our people, in so far as their realization of the importance of the subject is concerned.

Not every man is an active sportsman, nor is every man actively engaged in the fishing industry; but nearly every one is in some way a consumer; and through some one of these channels of interest we ought to gain access to the minds of the people, who ultimately have the power to influence legislation.

It is then by a process of education, or *publicity,* that many who have not been interested in particular must be made to feel that the matter belongs to them personally. In some way we must put the facts before them, arouse individual interest, and shape public opinion.

For "It is well known that public opinion is the strongest force in all the world but one. Public opinion is the dominating force at all times, and never yields its dominant sway of the will of the people until truth proves its error. So truth becomes the strongest force in the ultimate."

The lack of public opinion upon questions pertaining to the welfare of the fishing interests is due to the fact that the people in general are not informed on the subject and

do not realize the importance of the interests which *they have* at stake.

Public opinion is essential to obtain increased appropriations for the protection, propagation, and distribution of food and game fish, and to secure the enactment of legislation for the preservation of our lakes, rivers and streams. To secure this great force publicity campaigns are a necessity. Such campaigns may be conducted in many ways.

A publicity page can be prepared, and offered gratis, to the leading county papers of the country, in the form of plate matter. In this manner a large circulation is secured at a small cost.

Through the medium of specially prepared papers and addresses the most forceful and interesting facts and figures may be put before the people.

Fish commissions in every state should issue bulletins to the newspaper press of their respective states. This form of publicity has been adopted by many departments of state and federal governments with gratifying results.

In Illinois we have the "Fish Conservation News-Letter," which publishes many of the papers and addresses from the Transactions of this Society (The American Fisheries Society). Copies are sent to each legislator, to every person interested in recreative or commercial fishing, whose name and address can be secured, as well as to each candidate for state senator and representative, and to a large number of editors of weekly newspapers, many of whom have republished some of its articles. We also have the "Illinois Fisherman," a monthly journal devoted to inland fisheries, commercial and recreative, and we have reason to believe these will assist materially in securing the enactment of desirable amendments to our present law, and in increasing our appropriations.

If every member here would occasionally prepare a short article on the subject he is particularly interested in, and have it published in their local newspaper, it would aid considerably in creating favorable public opinion. We have

gentlemen in this Society who are qualified, by education and practical experience, each to take his place among the foremost magazine writers on special subjects. Why do we not hear from them through the leading magazines?

We have no one to blame but ourselves for the non-recognition by the general public of the importance of our fishing interests, and the danger to the health of the people, as well as the fishes, of this country in the indiscriminate dumping, by corporations and municipalities, of all manner of refuse into our lakes, rivers and streams.

Is not this subject of sufficient importance to justify this Society in using its far-reaching influence with the Bureau of Fisheries to secure the publication of a monthly bulletin to be sent to the newspaper press of this country?

CESTODE CYSTS IN THE FLESH OF MARINE FISH AND THEIR BEARING ON FOOD VALUES

By Edwin Linton

I. POPULAR INTEREST IN PURE FOOD TOPICS

One will look far to find a subject upon which the general public is more sensitive, or to which it reacts more readily than those matters which relate to its food and drink. A little knowledge of the subject matter of bacteriology, for example, while it may not become exactly dangerous, may easily become inconvenient and trouble producing. The public is justly sensitive to the adulteration of its food and, very rightly, is ready to visit swift and sure punishment on those who for increase of their own profits make the article which they sell different from the description which appears on the label.

II. PURPOSE OF THIS PAPER

There is a class of facts, however, that is related directly to our food supply, which man's cupidity has not originated and concerning which the public is very imperfectly informed. This is the class of facts that may be introduced at this point under the caption of animal parasitism. It is my purpose in this paper to discuss the question of animal parasites, but in so doing I shall aim not so much to impart information as to disclose points of view that should go some way toward dispelling prejudice. Some attempt of this sort seems to be made necessary in order to prevent misapprehension concerning the food value of those species of fish which are liable to be parasitized in portions that are used for food.

III. GENERAL CONSIDERATION OF ANIMAL PARASITISM

It does not require much experience in the classification of living things to teach one that the boundaries of what at

first sight seem to be natural and obvious groups are far from being hard and fast lines. For example, what at first blush appears easier to do than to divide animals into parasitic and non-parasitic forms? An attempt to place the animals with which one is acquainted in one or the other of these groups soon brings one to consider degrees of parasitism. For example, there are the familiar insect parasites, many of which lead independent lives but find their most congenial habitat in those jungles of hair and feathers which they find on the outsides of mammals and birds. Some of these insects, it is true, as the bot-fly, enact a part of their life history as internal parasites finding favoring conditions in the alimentary canal of the horse, but in their adult stage are as truly children of the light and air as the butterfly. Then, in such a classification, where is the mammal to be placed? During its uterine existence it is one of the best examples of true parasitism to be found in all the empire of nature. Following this important and essential act, though it is played, as it were, before the curtain is raised, comes another in which the young mammal is a highly specialized, but none the less true, ectoparasite. The classifier thus discovers, crown of creation though he be, that for a time he himself has been, so far as his method of taking and receiving nourishment is concerned, among the lowly ectoparasites and the lowlier internal parasites.

Shifting our point of view slightly, it may be remarked that the fauna and flora which are for a greater or less portion of their existence within other animals, are themselves living things, and their tissues may and do become food for some of the animals which eat them. An example, from many at hand, is a cestode (*Rhynchobothrium imparispine*) the adult stage of which occurs in the winter skate (*Raja ocellata*) and a few of its near relatives. Glancing over my check-list, I find that I have recorded cysts of this species from no less than 34 species of the marine fishes of New England. Now these 34 species comprise kinds such as silversides, smelt, mackerel, etc., which are eaten by a

large number of species of our food fishes. Without doubt, therefore, every bluefish, bonito, flounder, mackerel, scup, sea-bass, squeteague, and the like, which has attained marketable size, has taken into its alimentary canal, along with its food, large numbers of larval tapeworms which have been as completely digested and with as much profit to the eater as were the tissues in which the cysts were embedded. Many examples of this sort can be named. Indeed it is worth while to say in passing that if the sharks and skates were to be exterminated almost the entire list of encysted parasites in the flesh and on the viscera of the bony fishes would cease to exist. The list of cestode parasites that are adult in the alimentary canals of teliosts is a very short one, while that of those which are adult in the intestine of the sharks and skates is long. Furthermore, I do not know of any single species of cestode worm that becomes adult in both a selachian and teliost. On the other hand, several examples have come under my observation of species of cestode worms which are confined to a single species of shark. A notable example of this is a large tapeworm which I have found only in the tiger shark. It has been present in large numbers in all the sharks of this species that I have examined, but has not been met with in any other fish. Its life history is as yet not known. In whatever host or hosts it passes its larval stage there can be no doubt that such hosts, together with the larvæ of this cestode of the tiger shark, are continually being eaten by other fish both teliosts and selachians. The tiger shark is far from being exclusive in its diet, the list of stomach contents ranging from a pure fish diet to the varied contents of the slop pail of a ship's galley, including even cotton yarn and tin cans. Similar cases could be cited if it were necessary in order to establish the proposition which I wish to make clear, viz., that although the encysted stages of cestode worms may have wide distribution amongst specific intermediate hosts which themselves form the food of an equally large number of species of fish and birds, they

are, as a rule, able to resist the digestive juices of but a limited number of closely related species, in some cases, of but a single species to which they have become adapted. From this generalization comes the comforting thought that, even if we had not acquired the habit of cooking our food, which effectually puts a stop to any possible infection from encysted cestodes, the chances that a larva, which is known to become adult only in the winter skate, or in a single species of shark, should find congenial soil in the alimentary canal of a warm-blooded mammal, are too remote for even momentary consideration. In other words, animals, and among them we may include man, are naturally immune with respect to a large number of parasitic forms that undoubtedly from time to time find their way into the stomachs of the eater along with the food.

IV. PERSISTENCE OF PREJUDICE

The difficulty attendant upon the eradication of deep-rooted prejudices is well known. When the prejudice has to do with food material, and is not based on individual dislikes, but affects the people as a whole, such can be driven out only by fasting which merges on starvation, or by the reiteration of sound reasoning backed up by experiment and demonstration. Thus the splendid work of Field on the mussel and on the dogfish, although entirely convincing to those who with him put the matter to the test of taste, is but slowly bearing fruit, and an immense source of valuable food which has been unused, simply because of an unreasoning but by no means unreal prejudice, is slowly beginning to find its way into our markets.

In the interests of science it became my duty a few years ago to call attention to the prevalence of a cestode parasite in the flesh of an excellent food fish, the butterfish (*Prionotus triacanthus*). Since that disclosure I have found that a very strong prejudice has arisen against this fish in the minds of a few individuals. This result is no doubt natural,

but since the case is fundamentally different from that of trichina in pork, or "measles" in beef, it seems to me to be advisable to make an attempt to prevent the prejudice, which as yet is confined to a few individuals, and based, in great part at least, on misapprehension, from growing to such an extent as to banish an excellent food fish from our markets.

V. IN DEFENCE OF THE BUTTERFISH

The butterfish is exceptional among our marine food fishes in that a considerable number of them have a small cestode encysted in the flesh. These cysts are small, one millimeter or less in diameter, and occur near the vertebræ, usually on the ventral side of the back-bone between the hæmel spines. Now and then a fish is found which may have many hundreds, or, in exceptional cases, a few thousands, of these cysts in the flesh. It is worthy of note in passing, and will be alluded to in another connection, that the act of removing the back-bone, which is sometimes done in preparing fish for the table, removes practically all of the cysts, even in the most highly parasitized cases. Now these cysts represent the larval stage of a small cestode whose adult stage is passed in the intestine of a limited number of species of shark, notably the hammerhead. And just here it must be confessed one finds himself face to face with an unpleasant and somewhat delicate situation. Cestodes are not only worms but tapeworms at that, and, say what one may, these words call up unpleasant associations. When it is learned, therefore, that the mess of butterfish, which a customer is about to buy, stands a good chance of having a greater or lesser number of larval tapeworms in the flesh, there should be little wonder if the customer, who is acquainted with this possibility, decides to buy some other kind of fish.

Possibly some one may say: Why not leave the case of the butterfish where it is? The demands of science have been met by recording the fact that a certain species of ces-

tode exists, and that in the course of its life history it uses as its intermediate host a large number of species of fish, and for its final host one or two species of shark. That among its intermediate hosts the common butterfish is unique in that the cysts occur not on and in the tissues of the viscera but in the muscles. This objection has been sufficiently answered in the foregoing part of this paper. It now remains to instruct the public so that they may be able to use a valuable food fish without offending the most exacting demands for uncontaminated food and at the same time to show the true position which these humble forms occupy in the animal kingdom. I find from conversation with one who has seen a badly parasitized butterfish, but whose zoological education is that of the average citizen, that his line of thought is somewhat as follows: "The demonstrator showed me a fish whose flesh along the back-bone was full of little yellowish bodies that looked like fine fish roe. He said they were worms. Now you don't catch me eating wormy fish." In other words, the unfortunate word worm calls up visions of putrefying meat which should not be suggested by cysts in the flesh. I have examined large numbers of butterfish which have had these cysts in the flesh, but have never seen any signs of inflammation or of bacterial infection resulting from their presence. I therefore feel justified in saying that these encysted larvæ not only look like fish roe, but that their nutritive value cannot be much less than so much fish roe; that there is no evidence of any condition to suggest danger from ptomain poisoning; and that, therefore, there should be no hesitation about using butterfish as food. If one's imagination suggests unpleasant associations he may find relief in the thought that all the cysts in ordinary cases of even badly infested fish will be removed by the cutting out of the back-bone and its accompanying spines, between which the cysts occur.

At the risk of repeating what has already been said, the importance of the case demands that it be stated explicitly

that there is no reason for apprehending danger of infection from the ingestion of these cysts with the food, and that there is nothing in the cysts themselves, even when one is acquainted with them by microscopic study, to call forth the remotest suggestion of a qualm at the thought of swallowing one of them. With full appreciation of another valued and even luxurious article of food, it may be said that any one who can swallow a live oyster, at the same time knowing, as the zoologist knows, what he is swallowing, should not balk at a butterfish, no matter how many cysts it may harbor in its flesh. Indeed, the case is hardly a parallel one, because in eating an infected butterfish the chances are that all, or nearly all, of the cysts will be left on the plate with the bones, while along with the ingested oyster has gone the entire alimentary canal with its contents and any of the parasitic fauna and flora of the oyster species that the individual happens to be carrying, to say nothing of the possible germs of typhoid, if the mollusk in question happens to come from fattening grounds which the sewage of a city reaches before it is rendered innocuous by the cleansing waters of the sea.

With respect to the occurrence of cestode parasites in the flesh of marine food fish I have already pointed out (10) that the case of the butterfish is an exceptional one, an examination of other food fishes of the Woods Hole region having shown that the occurrence of parasites in those parts of the fish that are used for food are extremely rare, more unusual, I am sure, than is the case with the warm-blooded animals which form our staple flesh diet.

VI. TABLE SHOWING THE OCCURRENCE OF CYSTS IN BUTTERFISH

The last tables showing the results of the examination of butterfish for flesh parasites which I have published included the results of the investigation of the summer of 1908.

Following is a similar tabulated statement for the years 1909, 1910, 1911 and 1912 to the date of writing, August 19.

Year	Number of fish examined	Length of fish in centimeters	CYSTS SEEN					
			Very numerous	Numerous	Many	Few	Very few	None
1909	279	20 and over	118	28	27	29	54	23
	134	15 to 20	51	16	18	17	14	18
	43	10 to 15	2	4	9	3	13	12
1910	306	20 and over	51	34	32	36	79	74
	102	15 to 20	14	18	11	13	18	28
	8	10 to 15					1	7
1911	183	20 and over	19	26	28	19	36	55
	154	15 to 20	31	19	37	30	13	24
	65	10 to 15	10	8	9	15	16	7
	273	Less than 10	66	66	78	36	24	3
1912	298	20 and over	35	45	34	38	66	80
	175	15 to 20	22	13	13	28	34	65
	258	10 to 15	13	17	11	29	46	139
	217	Less than 10				1	2	214

The result of the examination of small butterfish in the year 1911 appears to be exceptional. In other years I have found the small butterfish to be but sparingly infected.

On September 15, 1911, I examined a lot of 223 butterfish ranging in length from 68 to 100 millimeters, and made the following record of cysts found: Very numerous, 63; numerous, 54; many, 62; few, 24; very few 19.

It is an interesting fact that the butterfish in the Woods Hole region that are taken late in the season show a higher percentage of infection than is shown by those taken earlier in the season.

VII. BIBLIOGRAPHY OF OTOBOTHRIUM CRENACOLLE, THE FLESH PARASITE OF THE BUTTERFISH

(1) 1887. Notes on Entozoa of Marine Fishes of New England.
Report of Commissioner of Fish and Fisheries, p. 849-853, pl. XIII, fig. 9-15, p. XIV, fig. 1-4.

(2) 1897. Notes on Larval Cestode Parasites of Fishes.
Proceedings U. S. National Museum, XIX.
Some of the cysts recorded under the genus Tetrarhynchus belong here, p. 807-809, pl. LXVI, fig. 6-9.

(3) 1900. Fish Parasites collected at Woods Hole in 1898.
U. S. Fish Commission Bulletin, XIX, p. 273.

(4) 1900. Parasites of the Fishes of the Woods Hole Region.
U. S. Fish Commission Bulletin, XIX, p. 428; p. 453-454 (recorded as Rhynchobothrium), pl. XXIII, fig. 255-256a, pl. XXIV, fig. 265.

(5) 1905. Parasites of Fishes of Beaufort, N. C.
Bulletin of Bureau of Fisheries, XXIV, p. 326, 331, etc.

(6) 1907. A Cestode Parasite in the Flesh of the Butterfish.
Bulletin of the Bureau of Fisheries, XXVI, p. 111-131, 2 plates.

(7) 1908. Notes on the Parasites of Bermuda Fish.
Proceedings U. S. National Museum, XXXIII, p. 99.

(8) 1908. Helminth Fauna of the Dry Tortugas. Cestodes.
Papers from the Tortugas Laboratory of the Carnegie Institute of Washington, I, p. 185.

(9) 1910. Notes on the Distribution of Entozoa of North American Marine Fishes.
Proceedings of the Seventh International Zoological Congress, Boston, 1907, p. 5, 9, 10 of advance print.

(10) 1910. Notes on the Flesh Parasites of Marine Food Fishes.
Bulletin of Bureau of Fisheries, XXVIII, p. 1195-1209.

FEDERAL CONTROL OVER FISH IN BOUNDARY WATERS

By Henry Hinrichs, Jr.

I realize that the time of this convention is limited, and that other questions of an importance equal to that which attaches to my subject are to be discussed. I shall therefore be brief in my treatment of the topic selected.

The majority of those engaged in commercial fishing are not free from the temptation to obtain possession of as much of the world's goods today as is possible, with utter disregard for what becomes of tomorrow. This desire for wealth, characteristic of the human race, unchecked by absence of wise laws or the failure to enforce the same when enacted, results in a wholesale destruction of an almost incalculable number of small, immature fish. Unless one has witnessed the landing of hauls of fish from ponds and trap-nets in the spring of the year, the enormity of the waste so incurred cannot be fully realized. It is no uncommon thing to see from ten to twenty tons of small pike, perch, bass, and herring, each fish averaging less than ¼ lb. (where the average size of mature pike and herring is ¾ to 1 lb.) brought into one port alone daily for a month or more each spring. A goodly proportion of these, on account of their extremely small size, are taken to the fertilizer plant. No matter how much money the Government may expend on the propagation of food fishes, the depletion of the commercial food fishes can only be temporarily deferred unless some drastic measure in the line of rules and regulations governing fishing be adopted. A continuation of the present policy will mean that, inasmuch as the fish are not given a chance to reach a state of maturity, it is only a question of time before it will be next to impossible for the fish culturist to obtain a sufficient supply of mature spawn to warrant the operation of fish hatcheries.

I cite the case of our local hatchery, the superintendent of which was unable to procure more than one-third of the ordinary quantity of mature pike spawn, due to the complete failure of catches of mature pike for four successive seasons. It is absolutely useless, it appears to me, to expend any money on the gathering and hatching of the spawn and to incur the expense of shipping and liberating the small fry when anyone who so desires may fish whenever or wherever and with any kind of a device he pleases. It seems to me that there ought to be an opportunity for every fish to reproduce its own kind, either by natural deposit of its spawn or by enabling the fish culturist to obtain the spawn and hatch the same artificially. Any device purposely created for the catching of these small, immature fish, or the use of any kind of a net with meshes insufficiently large to permit the escape of the small, immature fish, should be prohibited.

The fishing laws placed upon the statute books of the different states bear witness that it has been realized that some one must exercise some control over the commercial fisheries in order that not only the present consumers but those of the future may be protected. Some states have excellent laws, which, if enforced, would in a large measure lessen the waste; but one giving more than cursory attention to the fishing laws realizes that but very few efforts at enforcement are attempted. This failure to enforce these laws is due presumably to the lack of uniformity in the laws of the different states bordering on the same body of water. One cannot help but admit that it would be a grave injustice to the fishermen of Pennsylvania, for instance, to prohibit them from using a certain destructive device, when his neighbors in the adjoining state of Ohio are permitted to make use of the same.

The failures of numerous attempts in the past to have uniformity in the fishing laws in those states and provinces bordering on Lake Erie are proof of the futility of further efforts in that direction.

The average person engaged in fishing or handling of fish will consider any measure tending to regulate the fishing as inimical to his interest and any candidate for office inclined to favor regulations will not receive the interested one's support at the polls. It can readily be seen that in a community where fishing is one of the leading industries no one favoring the discontinuance of the present destructive methods of fishing will be elected to represent the district in the legislature.

While this same condition confronting a candidate for the state legislature confronts the candidate for Congress, nevertheless the part of the constituency interested in fishing is proportionally much smaller in a congressional district than in a legislative division, therefore a candidate for Congress would not be so apt to be pledged to fight against measures for the benefit of conservation as the candidate for the legislature would be. Furthermore, the federal authorities are inclined to be more strict in the enforcement of the federal laws than the state authorities seem to be with the laws of the state.

Authorities on constitutional law contend that the federal government has a right to regulate the fishing in the boundary waters. In pursuance of such right, a commission was appointed a few years ago for the purpose of investigating and studying the fishing from the Atlantic to the Pacific in order to be able to draft and submit to Congress rules and regulations, the adoption of which would inure to the benefit of both producer and consumer, (1) by preventing the continued indiscriminate destruction of immature fish, and (2) by limiting the number of nets to be fished at one time by any boat to cause the production of a fresher and more wholesome article of food. These rules and regulations, drafted after a thorough and unbiased investigation by the International Commission, comprised of eminent authorities on fish and fish life, have not become laws. Those selfishly interested got the ear of the "near statesmen" at Washington, and through them caused the emasculation

of the bill to such an extent that the enactment into law of the amended form would have been an insult to anyone of average intelligence. The original bill was not permitted to become a law for the reason that there was not a strong advocate battling for the people's rights nor anyone interested who could have aroused the necessary public sentiment.

Today we are as far from the solution of this important problem as ever. Ingenious devices for the catching of the small fish are used in increased numbers, the number of small fish taken annually increases with them, and the number of mature fish caught decreases proportionately. As long as those interested in the fishing industry are permitted to judge for themselves as to what is right and what is wrong, just so long will such conditions as now exist continue. There is only one way, it seems to me, by which this tremendous waste may be stopped, namely, as before suggested, by the federal government's assuming control over the fishing in boundary waters, thereby so conserving these valuable natural resources that not only we may enjoy a plentiful supply of wholesome food fishes, but that like benefit may be in store for those who are to follow us.

No one realizes more clearly than myself the tremendous benefit of artificial methods of propagating fish, but I believe that I do not err when I state that as equally important as the artificial propagation of fish is the wise regulation of the catching of the same. I believe that efforts exerted along these lines are in the right direction and therefore take the liberty to suggest that a committee be appointed by the American Fisheries Society to investigate the present condition of commercial fishing on the Great Lakes, and to submit a report of such investigation at the next annual meeting.

RECENT LEGISLATION AFFECTING THE FUR SEAL

By C. H. Townsend

The Sixty-second Congress, in passing the bill to give effect to the treaty between the United States, Great Britain, Russia and Japan, for the suppression of pelagic sealing, attached an amendment providing for a closed season of five years on male seals on the Pribilof Islands.

This endangers the treaty, as it cuts off for five years the percentage of profits to which the other countries are entitled by the provisions of the treaty. It will result in too many fighting males and a consequent loss of pup seals by trampling. It will also mean a loss of over two and a half millions of dollars to the Treasury in five years, as the skins of old males are of no value. It will destroy the most valuable herd of blue foxes in the world, the large size of the fox herd being dependent upon the abundant food supply of the seal killing grounds. The fox fur resources are worth almost as much as is the seal at the present time.

The amendment was against the recommendations of the Bureau of Fisheries, and also against the advice of all the American and British naturalists who have studied the fur seals on the Pribilof Islands.

The outside sealing interests have always been represented at Washington by an active lobby. This lobby has been discredited and defeated several times in the past, and could not have won in the present case without the very active help of certain respectable persons, who no doubt mean well, but not one of whom had ever been on the Pribilofs or understood the peculiar nature of the fur seal. These gentlemen failed to perceive that they were being used to further the future exploitation of the seals by private interests. It created considerable political disturbance, chiefly by assailing the reputations of men connected with the fur seal service. A future move of the seal lobby, when the

critical moment arrives, will be to propose a return to the old method of having the killing done by lessees, instead of by the government.

Among other charges the charge was made that the Bureau of Fisheries had been killing *pup* seals. A part of the annual catch made on the Pribilof Islands was classified in the printed catalogue of London sales as "pups," "small pups," and "extra small pups." It was shown by officers of the Bureau that these terms, long used in the fur trade, did not mean either yearlings, gray pups or new-born pups, and skins duly certified by furriers as *"pups," "small pups,"* and *"extra small pups"* were shown to the House Committee. They were actually skins of various sizes of two and three-years-olds. In spite of the facts presented, the baseless outcry of the seal lobby against "pup killing" won out.

The surplus males of the polygamous fur seal have long been killed on the Pribilofs, because they were actually a *surplus,* not required for breeding purposes. The outcry against "pup killing," even if there had been such killing, is utterly senseless. If the skins of a lot of bull calves should be found to be worth as much as could be realized from the sale of an equal number of full grown steers, would any stock breeder think of raising them?

The *age* at which surplus males of either seals or cattle are killed does not matter so long as they are disposed of when most profitable, provided sufficient males are saved for breeding.

Very fortunately for the fur seal, the ten-year closed season proposed by the seal lobby fell through. Although Congress had no clear understanding of the fur seal situation, it *could* understand that a ten-year closed season on males would mean the loss to the Treasury in ten years of fifteen millions of dollars. Just what will be done later on to rid the breeding grounds of their hordes of big fighting bulls remains to be seen. The saving of the entire stock of

males is against all biological experience. No breeder of polygamous animals does anything of the sort.

The wastefulness resulting from this vicious amendment is not really as serious as its intent to fix responsibility for the condition of the herd *upon the Government,* instead of on the pelagic sealers, who prey upon the female portion of the herd, and who alone are responsible for its present reduced condition.

DISCUSSION

PROF. L. L. DYCHE, Kansas: I do not know as I can add anything to this excellent paper. It gives me pleasure to endorse everything Mr. Townsend has said in his discussion of the subject. I was in Washington and appeared before a Senate Committee and some members of Congress and expressed myself in rather vigorous terms along lines so splendidly set forth in this paper. It is hard to understand why Congress could not be made to understand the real and true condition of the fur seal situation as presented by scientific men and naturalists who have given years to the study of the problem. About the only way it can be accounted for is that certain parties have spent a great deal of time in lobbying with members and misrepresenting the real situation and the real conditions on the Pribilof Islands.

I have spent several months on the coast of Alaska and have some knowledge of the fur seals, and I think I understand the situation as naturalists understand it who have been up there and studied it for years. When it comes to getting a law passed in favor of the seal industry and in favor of conditions that would promote the welfare of the seals themselves and that would save a great amount of money to our own Government and be fair to other governments concerned, and be absolutely fair to all conditions of seal life, it seems almost impossible to make Congress comprehend the situation. This seemed to be especially the situation during the session of Congress last spring. The mixed condition of things at that time seemed to have been brought about by a heavy lobby against the real interests of the seal herd and the real financial interests of this country. It was freely rumored at Washington that certain interests with ulterior and selfish motives were figuring against the interests of the seal herd and the interests of the Government, and were working for the passage of this bill. It would seem that there are certain parties formerly engaged in certain kinds of seal business who have hopes of getting and keeping a loose-jointed law on the books that would permit of a loose-jointed business being carried on in the "seal fisheries." A law would suit them that would make it possible to stir up some sort of feeling with England or Japan that would lead to pelagic sealing in one form or another. Such a

condition of things would favor certain parties and certain interests. Some hidden influences of such character and nature might be found if one should look in the right place that would explain a condition of things that makes it almost impossible to get a law passed that would adequately and fairly protect both the seals and the seal interests.

PRESIDENT: I think that is a good suggestion and I hope every member will go to his respective state and try to influence his member.

PROFESSOR WARD: Unfortunately this is an act on our statute books passed against the unanimous testimony of a Board of Experts and the unqualified opposition of the Scientific Department of the Bureau of Fisheries, having naturally a general relation to this matter.

It is still more unfortunate, and I think I may say from a scientific standpoint, absurd, situation, to consider that the Senate proposition was pushed by Senator Hitchcock, of Nebraska, a man who represents one of the greatest cattle-raising states in the Union, who advocates a principle which would destroy the stock industry, which is as unscientific and as unthinkable on the part of any man familiar with the raising of cattle or sheep or chickens, as anything possible could be. And I think it is time for this body, representing the entire sentiment of the entire country in the field of fisheries, to protest against the action of the Congress of the United States, when that action is determined, not by scientific principles, but by something else, which we have no official reason to recognize, but which we cannot help recognizing as being entirely unscientific.

MR. SEYMOUR BOWER, Detroit: Believing as I do that Dr. Townsend has stated the facts in the case, I move that the Resolutions Committee be directed to prepare a resolution protesting against the action of Congress and recommending the repeal of this obnoxious feature of the law.

Motion seconded.

PRESIDENT: I expect from Dr. Ward's talk that the resolution is already prepared.

DR. FIELD: As a practical matter there is only one way to bring this subject forcibly to the attention of Congress, and that is to have every member of the Society, so far as possible, put the matter directly up to his senator and representative, and state that he and his friends are personally interested; and in that way some sentiment can be developed in Congress.

THE KANSAS FISH LAW

By L. L. Dyche

The last legislature passed practically a new law to govern the fishing interests in the state of Kansas. This law contains a number of new features. However, the intent and purpose of the law is to protect and increase the supply of fish in the ponds, lakes, and streams of Kansas.

One of the features of the law not well understood is the provision that only one hook can be used on a line. The object of this clause in the law was to prevent catching fish with a bunch of hooks tied on a line and used as a snag or grab hook. When the water is cold, and especially when it is covered with ice, it frequently happens that the fish bed in deep water beside an old log or in some other convenient place. This makes it possible for certain persons with a bunch of hooks on the end of a line, to drop the hooks into such schools of fish and to snag the fish by giving the hooks a quick jerk. Great numbers of fish are sometimes taken in this way. Many cases have been reported where fish have been taken below a dam, or other favored place where fish naturally congregate, by the use of grab hooks or snag hooks.

There could really be no objection to fishing in the old-fashioned way, with two or three hooks on a line. It is hard to frame a law that will prevent using three or four hooks on a line as grab hooks and at the same time allow a person to fish in a proper way with three or four hooks on a line. However, twenty-five hooks may be used on a trot-line provided they are a reasonable distance apart and used in a stream as a trot-line. Most sportsmen use but one hook on a line and prefer this method of fishing to using three or four. The law does not prevent using several lines, each with one hook on it.

Another feature of this new fish law provides that any citizen of the state of Kansas who gives a fifty dollar bond

may obtain a permit from the Fish and Game Warden to own and use, during certain seasons of the year and under certain prescribed conditions, a seine with meshes three inches square. This law makes it possible for any citizen to own and use a seine. The idea of a three-inch-mesh seine is that fish weighing from three pounds upwards may be caught. After fish reach this size, it is proper that they should be caught and used for food. Many of the larger fish, such as the buffalo and the carp, rarely take a hook, and when they do they are hard to handle and land successfully. By the use of a seine they can be taken more readily, and lawfully.

A seine with meshes three inches square makes it possible for the young fish and fish up to three pounds in weight to pass through its meshes, and as most fish spawn at least once by the time they reach the weight of three pounds, this provision of the law guarantees a continual supply of fish in the streams. It seems to us a wise provision of the law that protects the young and undersized fish from being seined until they can spawn at least once.

After the fish, especially such varieties as carp and buffalo, have reached a weight greater than three pounds, it seems not only proper, but advisable, to allow them to be caught by use of a seine and used for food.

At first certain parties were inclined to make light of this provision of the law, but the number of letters received from persons who have used these seines indicate that they are pleased, and they pronounce the law a good one, as it works for the benefit of both the fish and the fishermen. One correspondent wrote that the farmers in his locality were pleased with the law. He said: "The farmers do not have time to fish with hook and line and when they do they seldom catch anything." "This law," he continues, "makes it possible for the farmers to get fish without violating the law."

GRAYLING

By H. D. Dean

I am informed that there were originally no grayling on the west side of the mountains in Montana. I believe this is true. Three years ago grayling were planted in Georgetown Lake, west of Anaconda and 20 miles distant. It is an artificial lake of 2,600 acres, and I have been told that grayling weighing three pounds have since been caught in that lake. I have seen many that weighed two pounds. Eggs have been taken from them for two seasons now. The fish are there, very plump and fat, and larger than any that are in the native waters on the east side of the mountains. There are, as far as I know, no grayling on the east side of the mountains that approach the size of those in this lake, even at the age of three years. I believe grayling can be reared successfully in any lake that has minute food for the young.

I believe most of you are aware that the eggs of the grayling are first placed in jars, and that they are left there until they are well eyed. Then the eggs are taken from the jar and placed on trays, where they are kept until they are hatched. Our experience this past season indicated that the period just before hatching was the only dangerous one, as they may smother at that time, but I believe this difficulty may be overcome.

After they are hatched they go to the bottom of the trough and stay four or five days. Then the fish begin to swim up in the water a little like the whitefish does. At this period they may be transported with safety. We took a can of them last spring when I thought I was going to Georgetown Lake next day, but something happened to prevent the trip. We had put up 3,000 fish in a can, which was very thin, of course, for fish of that size; but that can of grayling remained four or five days in the hatchery before it was taken out. We had to have room, and so we put them in

the can, and we did not do a thing to the fish during that time except that we let a siphon hose run on the outside of the can to maintain the proper temperature.

Grayling, as you know, were found originally in the upper waters of the Missouri, in the Madison, Jefferson, and Gallatin Rivers, and in their tributaries. I believe those are the only waters in the state where grayling were found.

This year we took 100,000 grayling to a lake 5 or 6 miles long and 2 miles wide. This lake contained some of the largest native trout I ever saw, some of them weighing 18 pounds. The size of the trout showed conclusively that there was a large amount of food in the lake, and I thought it would be a good place in which to plant grayling. In two years some results ought to be apparent from the plant made this year.

I think you should plant grayling in small lakes, or else in a river that has large pools. I believe that Twin Lakes in this state, or a small lake like the one near the Leadville hatchery is all right. I believe if you put your little fish in there in two years you will have fish that you can take eggs from.

I do not know that I have anything more to say, unless some one has some questions on the subject to ask. It is easy for me to say I do not know when such is the case, as I have been in the work such a short time.

DISCUSSION

MR. S. E. LAND, Colorado: What was Dr. Henshall's experience with the Montana grayling at Bozeman? Did he hatch them out and handle them successfully, or approve of the distribution of them?

MR. DEAN: I cannot tell. I do not know of any waters that Dr. Henshall put the grayling in that ever amounted to anything.

MR. D. C. BEAMAN: This grayling question is a matter of considable interest on account of the generally conceived opinion that they cannot be artificially reproduced. We have a fish culturist in Colorado, Mr. Hasselkus, of Creede, who is one of our best fish culturists; I hoped he would be here today. He tells me that this summer he got 50,000 grayling fry from Montana, and planted them in a lake in southwestern Colorado. They are now, as I remember, about an inch and a

half long. I mention this merely that the subject may be brought up at the next meeting, by which time he will be able to tell us how those fish have got along, more as a foundation for future investigation, to see how they will get along in a lake, than anything else. My idea was that they ought to be in a stream, but from what my friend says it does not seem to be essential, and it is to be hoped that we can prove in time that grayling can be raised in lakes successfully.

MR. C. K. CRANSTON, Pendleton, Ore.: L want to ask Mr. Dean what method of procedure is necessary, or what opportunity or chance there will be of making purchase or exchange of eyed eggs or fry best adapted for transportation to Oregon. We have a number of lakes which I think will be well adapted to stocking with grayling. I have always heard of the fish and if practicable I would like to get some.

MR. JAMES NEVIN, Madison, Wis.: Several years ago they were planted in the Brule River, and quite a number of them have been caught there. I have not heard for the last couple of years, but I met parties from the Brule three years ago at Madison, and they said there were quite a number of the fish in that river.

MR. C. W. WILLARD, Rhode Island: Ten years ago I obtained 20,000 eyed eggs from the station at Montana. They arrived in good condition and we hatched out at least 90 per cent of them; but after hatching we found it utterly impossible to find any kind of food that they would eat. We had the fish in pure artesian water. I believe that had we put the fish upon hatching into the creek water that we might have had some measure of success. As it was, in a very short time our little grayling were all eyes and head and finally died of starvation.

MR. CRANSTON: What is Mr. Dean's experience on the subject of shipping and the possibilities of our getting eggs or fry and being successful with them in Oregon?

MR. DEAN: The only place in Montana that eggs have ever been taken that I know of is the upper waters of the Red Rock and within two years at Georgetown Lake.

MR. CRANSTON: Have you any surplus that you could dispose of?

MR. DEAN: I cannot tell in advance. This season we took about a million eggs. The Government has a field station at the upper waters of the Red Rock and all the grayling distributed anywhere have come from there. All Montana grayling have come from Upper Red Rock. They have to be sent by wagon 45 miles and then shipped by express. Another difficulty in shipping the grayling is that they must be kept very cold.

MR. CRANSTON: A case containing a quarter of a million of eggs would be of comparatively small bulk?

MR. DEAN: Yes, the eggs run a little larger than whitefish—700 or 800 to the ounce; and the Government usually only sends about 25,000 to 50,000 to an applicant; although a year ago last spring, when I had the Bozeman station, we had a little better year and had two and a

half million eggs and could have doubled the quantities; but owing to the difficulty of getting word to the sub-station in time, it was not done, and only about 250,000 were shipped out altogether; and all the rest of the eggs were hatched and fry planted in the natural waters there.

The Red Rock Lakes and the little streams where they catch the spawning grayling are about 7,000 feet above sea level. I think the Georgetown lake has an elevation of 6,000 to 7,000 feet.

MR. CRANSTON: What is the temperature of the water on an average?

MR. DEAN: I have not taken the temperature of the water in Georgetown Lake, but it is an artificial lake and not excessively cold.

MR. CRANSTON: And they thrive there, do they?

MR. DEAN: Oh, my, yes. That is the finest place in the world for them, and they are the finest fish I ever saw.

MR. CRANSTON: There is no doubt but they would do well?

MR. DEAN: They will stand much warmer temperature than the trout and will carry much better when small than trout.

MR. CRANSTON: That is, the fry after being hatched?

MR. DEAN: Yes—4 or 5 days after hatching when they begin to swim out.

MR. CRANSTON: How about the difficulty of feeding which has been mentioned?

MR. DEAN: I would not want to try it, unless you can run creek water to them. Dr. Henshall did have a little success in feeding by using water from a creek.

MR. CRANSTON: Your method is to liberate them as soon as they swim up and seek food.

MR. DEAN: Yes, same as whitefish. We will have some nice specimens at the Helena Fair and we can show you grayling from this lake that weigh over two pounds each, and we will have them on exhibition at that fair.

MR. G. H. THOMSON, Colorado: How do the grayling and trout do in the same stream?

MR. DEAN: Near the Madison power dam for a distance of 4 or 5 miles in length and a mile in width, on the Madison River, which heads away up in the National Park and comes down and helps form the Missouri at Three Forks, there are the grayling, the brook trout, steelheads and rainbows living together. Steelheads have been caught weighing over 12 pounds. They all do well. In Georgetown Lake natives, brook and grayling live together in peace and harmony, and are growing fast.

MR. THOMSON: On this proposition of the grayling I would like to say that up in the northern portion of Colorado there is a portion of the river above Fort Collins, above which, on account of the large dam used for irrigating purposes, our trout are not able to go, where

the Fort Collins Game and Fish Association have planted grayling; and they are trying it out, but I cannot say what the result will be.

MR. SEYMOUR BOWER, Michigan: Where were these fish taken from which you secured the eggs? Were they taken for spawning purposes and directly from this artificial lake or from tributary streams?

MR. DEAN: This artificial lake was made there because of two large springs—one the lake water covers; and the other spring is quite large, the flow being probably 5,000 gallons a minute; and it was in this stream that we had our trap 300 yards, perhaps, from the lake.

MR. WILLARD: I was told by some member of the association that he knew of a party in Colorado who had successfully introduced the grayling and that grayling were being caught in the waters in which he introduced them, of good size. I wonder if that gentleman is present?

MR. D. C. BEAMAN, Denver: I never heard of him.

MR. CRANSTON: I will say for the information of the last speaker that our Williamson whitefish is erroneously called grayling by many people in Oregon; and I have known it to be distributed as grayling. The outside appearance is similar and in western Oregon it has been called grayling for many years.

MR. LAND: That is the same case in Colorado and Wyoming. There are certain streams where these whitefish are found and they are classed as grayling by the novice; but according to Dr. Jordan they are the Williamson whitefish or the Rocky Mountain whitefish. Now, these Montana grayling, I agree with Mr. Dean, cannot be raised and fed; but they can be raised and liberated, and if out in lakes such as Judge Beaman mentions or Mr. Dean speaks of, they can be successfully propagated and distributed through other streams that are suitable. The streams where we find the Rocky Mountain whitefish are streams that have pools, and are not too rapid. We have several of these streams in our state and in Wyoming, and those are suitable for the life of the grayling. The grayling of Montana will grow in streams wherever we find the Rocky Mountain whitefish. The grayling in Montana was first discovered in the head waters of the Madison River, and *Thymallus montanus* is the scientific name for them. The only grayling known in Michigan is *Thymallus tricolor,* which inhabit the Manistee and Au Sable Rivers, found especially in pools. The other graylings reported by Dr. Jordan are found in Alaska and are known as *Thymallus signifer.* They have a much larger sized fin than any of the other. They can be successfully raised if planted as soon as hatched, but do not undertake to feed them.

MR. BOWER: In regard to the planting of the fry, do you place the fry in the streams in which they attempt to spawn, approximately, near the spawning grounds, or do you scatter them throughout the lake, and, if so, in what depth of water; what are the general methods of planting?

MR. DEAN: Most of the original plants were made in this little creek. We put them in both places this year; but I prefer putting them along the lake in the shallow water. At the time the grayling was put out this shallow water was not very warm—probably 45° perhaps; and there is plenty of food all along this Georgetown Lake,—especially the fresh water shrimp, which are thick in all the shallow water. The land around the lake was originally flats and almost marshy. Now, there are lots of places all around which are rather marshy. You cannot get out to the clear water in some of the places around the shores without boats.

MR. CRANSTON: Is there a central very deep part of this lake?

MR. DEAN: Probably, it is about 30′ to 40′ deep at the dam.

MR. CRANSTON: Most of our natural lakes are extremely deep, and the proportion of shallow waters around the edges is rather small; some are exceedingly deep and suitable for grayling.

MR. DEAN: I think it is largely a question of food. If there is food in the lake the grayling will do well.

PRESIDENT: I want to add my testimony in regard to replanting grayling. Mr. Nevin put grayling in the Brule River in Wisconsin, where there was never any before. I was with Judge Robinson two years ago and hooked a grayling, and I said, "My God, that is a grayling!" Judge Robinson said. "No, there is not a grayling in this river." But almost before the fish was landed I had another one. But those were the only two we caught, and we fished several days. But I know the Brule has got grayling there. They were planted by Mr. Nevin and the eggs came from Montana.

REPORT ON PROGRESS IN THE CONSTRUCTION OF THE NEW POND-FISH HATCHERY IN KANSAS

By L. L. Dyche

The contract for building the new and improved fish hatchery, at Pratt, Kan., was let to James R. Green & Company, Ltd., of Chicago, September 21, 1911. The following include the chief items in the construction of this hatchery, namely:

A concrete dam 500 feet in length, with an earth embankment extension of 200 feet built over piling. A concrete intake chamber with bronze and iron gates and other appurtenances for controlling the water. A water supply conduit of 21-inch vitrified clay pipe, 6,875 in length, with manholes and other structures. Approximately 147,000 cubic yards of levee embankment. Approximately 1,000 feet of 12-inch, 6,000 feet of 10-inch, and 15,000 of 8-inch vitrified clay pipe laid in trenches from 3 to 11 feet in depth.

There are 105 concrete structures and water transmitters with 197 bronze and iron sluice gates, mostly 8-inch, and five cast iron flood gates. There are 350 wire mesh screens 30x36 inches. These screens were made by fastening wire mesh screening by the use of copper wire on frames made of ¾ inch standard galvanized steel pipe.

The 83 new ponds now being added to the eleven in the old hatchery will make 94 available for immediate use. Plans are drawn for the addition of 17 more ponds. These ponds extend over a strip of ground one-quarter mile wide, and one mile in length. They will average about one acre each in surface area and will furnish something like 15 miles of shore line for old fish to breed on, and young fish to feed on.

The contract time for finishing this part of the hatchery was October 16, 1912, and it was finished and turned over to the state November 21, 1912.

Plans have been prepared and approved for the construction of twenty-two buildings on the hatchery grounds. They will include a fish and game building with an aquarium addition; six residences and cottages for assistants and caretakers on the hatchery grounds, and other such buildings as a power house, barn, and tool houses needed for hatchery purposes.

WATER POLLUTION AND OTHER NOTES

By Joseph H. Acklen

It is indeed an honor to address this body of men, a Society that has a proud record of nearly half a century behind it. Well could you rest upon the laurels which you have already won in the field of the propagation and protection of fish in this great country, but there is still a greater future before you. Conditions existing at the time of your organization 42 years ago have greatly changed in this country. Our population in that length of time has doubled. Intensive farming and manufacturing industries present for the men who are interested in the propagation and preservation of fish questions that have never heretofore arisen.

Your association and that of the game and fish commissioners are closely allied. They should work in thorough harmony, each assisting the other. The most serious question that you gentlemen have to face, and one in which there may be a little friction in some states, is where there are separate commissioners for fish and game. Where they are under one jurisdiction that difficulty does not arise. Therefore the need and necessity of harmony is all the more apparent, if success is to be attained.

The most serious proposition for the future is the question of what is to become of the fish that you gentlemen are raising, the output of your hatcheries, and that question is to be solved by some legislative restriction upon the pollution of our waters. Measures to prevent such pollution are frequently combated in different legislatures by manufacturing industries, and by municipalities which are not willing to see that their sewage is properly disposed of. I believe I could not do better than give you my views as I expressed them on a former occasion. "The pollution of public waters is our most common act and our most uncivilized practice. The casting of refuse in a stream results

only in transferring it from one neighborhood to another." From every point of view the matter should have consideration. There can be no doubt that, as a means of breeding disease it is one of the most productive. If there were no other means than the use of rivers and brooks to care for sewage and chemicals from factories, it would be a different proposition, but with modern septic devices that will care for it and do it well, there would seem no reason why proper legislation should not be had. Water which is foul enough to kill fish should be warning enough to localities that serious consequences would follow in other directions.

"The decrease in the supply of food fishes is traceable more to the pollution of waters than to any other cause, and stream pollution is going on at a rate proportionate to the increase in population and the development of manufacturing industries. The pollution of streams not only affects fishing for sport and commercial fishing, but the all important matter of the public health.

"The agencies at work are almost too varied for enumeration. In general, the pollution of water is caused by sawmills, pulp and paper mills, tanneries, starch, cheese, and sugar factories; gas, wood alcohol, chemical, glass, and dye works; oil refineries, distilleries, and breweries; logging, smelting, and mining; and by factories of all sorts. To this catalogue might be added the item of dead animals, which in the aggregate is an important one.

"There is hope for the early salvation of our mountain streams where the population is not yet sufficient to cause damage by sewage. Here we have to deal chiefly with such matters as pollution by sawdust and wood-pulp refuse.

"Recent experiments have shown that sawdust promotes the growth of fungus on fish eggs and kills both eggs and young fishes. The finer kinds of sawdust affects the larger fishes, getting into their gills, and dead fishes are found with considerable sawdust in their stomachs. Paper and pulp mills use lime, caustic soda, sulphuric acid, etc., all of which are deadly to fish life, when drained into streams.

"In spite of the fact that there are laws which prohibit the drainage of dangerous matter into public waters, there exists in factories without number secret waste pipes which are opened during the night, the outpourings of which are so deadly to fish life that the practice of operating them can only be named as dastardly.

"We have lived under these conditions so long that we are used to them. It is the old case of each for himself, with no thought of the health, wealth, or happiness of those farther down stream. In many beautiful streams, where fishing is still possible, fishes have become uneatable through tainting of their flesh.

"Sawdust can be kept out of streams, and at a very moderate expense. The wastes of mills can be kept on land and evaporated or otherwise treated. Water containing deleterious substances of all kinds can be settled, cleared, filtered, evaporated or purified by chemical processes. It is needless at the present time to argue against this point, since engineers everywhere understand methods of disposal suitable to various conditions. It is not only possible to keep wastes out of the water, but it is possible to turn them into profit through valuable by-products. In many parts of Europe sewage is not only kept out of the water, but valued as fertilizer."

At each session of the Tennessee Legislature since 1903 I have urged the enactment of a law to prohibit the pollution of our streams, the bill on this subject having been carefully prepared in accordance with like laws of other states, where the subject is no longer a matter of experiment. The opposition of mill and mine owners and certain manufacturers has, however, proven effective in defeating it.

These, in brief, are some of the views I have heretofore expressed on this subject; but there is one thing we must bear in mind,—we cannot secure results without the creation of a proper public sentiment. Back of all law there must be public sentiment, if that law is to be enforced; and one of the highest duties that we owe to the people of this

country, in view of the constantly increasing demands for fish as a food supply, due to the increasing cost of living, is to create and foster that sentiment.

In the south, and notably also in the west, the laboring classes are prone to eat too much hog meat. Hog and hominy are all right in moderation, but hog and hominy as an exclusive diet is very hurtful. Physicians have told me that the best antidote to an excess diet of pork is fish food; that if a man eats pork seven days of the week, he is likely to be sick; but if he can substitute fish food for two days out of the seven he can retain his health. Can there be any greater benefit conferred upon the public, upon the citizens of this great country, than the promotion and upbuilding of the public health. It is said that a laboring man is worth some $900 per annum for his mere labor; he is an asset if he is healthy; but if he is unhealthy he is not only a drawback to the community, but he is a burden to it.

Let us therefore from all these standpoints proceed with this work, and, Gentlemen, this Society is building to itself a monument which the future citizens of this country will point to with pride.

THE OYSTER AND FISH INDUSTRY OF LOUISIANA

By W. O. Hart

The oyster beds, still in almost their primitive state, form one of the principal resources of Louisiana, inasmuch as the oysters raised along the coast, and prepared in local factories, are one of the largest exports of the state. The oyster fisheries lie principally in St. Bernard, Plaquemines, Jefferson, Lafourche, Terrebonne, Vermilion, St. Mary, Iberia and Cameron Parishes (a parish in our state corresponding to counties in other states), and constitute an area of approximately 471,961 acres, on which there are 1,762 leases, covering 17,072.94 acres. The remaining area, while it is not under lease, is reported to be in every way susceptible to cultivation, and the grounds have been found to be some of the best producers in the country.

Therefore, while at the present time the oyster industry in Louisiana will compare favorably with any of the fisheries in the United States, it is believed to be as yet in its infancy.

The cheapness of the leases and the easy conditions under which the trade can be entered make an attractive offer to anyone so inclined, and is inducing many to take up the lucrative work. The lands aggregate an annual lease rental of $1 per acre and at present there are approximately 453,888 acres of productive bottoms to be chosen from.

Already engaged in the business, according to the leases granted by the Board of Control, are 1,762 fishermen, who find a ready market for their products among the local canneries and shucking plants. These canneries and shucking establishments supply nearly all of Texas—80 per cent it has been estimated—and all of Louisiana, besides a large wholesale trade in the North and East.

Of the leased acreage all has been tried and found to be most lucrative, and yet it forms but a minute part of the vast area which is available for oyster culture.

Kindred to the oyster fisheries are the shucking and canning industries, which furnish employment to several thousand families. In the city of New Orleans are located twelve shipping concerns which handle the raw oysters, while over the remainder of the lower coast are scattered fifteen other plants. These plants vary in capacity and output, although the output of each is almost unlimited, the work is conducted on the piece scale, by which the salaries of the employes are governed.

These plants during the season run at full capacity, while in the summer only a very small output for the furnishing of the immediate market is made. These plants are all well established, and during the busy season transients open up smaller plants and enter the field of furnishing the supply for the enormous demand for Southern oysters.

The direct shipping industry occupies an equally prominent position along with the canneries, especially in the winter months, as the fresh oysters for the trade in all the neighboring states are supplied from these plants. They also run on the scale of piece work, and almost unlimited supplies of oysters are shipped out annually.

Throughout the lower part of the state are scattered these plants where the oyster is prepared and shipped throughout the northern states, as well as to the adjoining states. On the lower coast, in the heart of the oyster beds, three of the largest plants thrive with many others at different points. These plants have their own shucking auxiliaries where the oysters are prepared for the kettle and then hermetically sealed in tin cans ranging from half pints to gallons, according to the demands by the trade. Also some of these oysters are shipped in bulk for use in restaurants, hotels and cafés.

Connected with these oyster canneries are also the shrimp departments where the shrimp, another product of the water, is put up in large quantities. The Louisiana shrimp even exceed the oysters in their excellence and renown throughout the country, being universally used in all

markets where they can be supplied by the local canneries. A feature of the oyster and shrimp canneries is the fact that there is practically no waste labor for which the operators of the factories have to pay.

The old-established custom of paying for only what they receive is the vogue in these plants, and for shucked oysters so much per pound for the raw material is paid to the shuckers, while the fishermen are paid in proportion to their catch.

VARIETIES OF OYSTERS

Nestling in the bottoms around Ship Island are found what are considered to be some of the best oysters in the world. These, together with the plants found in Four Bayou, bear the estimable record of excelling the celebrated blue points gathered along the coast of Long Island. Out on the verge of the Gulf of Mexico, where they are free from any taint that might be included in the river waters, these oysters are gathered and bring the best price on the local market. The Ship Island variety are found in great abundance on the reefs and bottoms surrounding that miniature island, while the Four Bayou variety are comparatively scarce, owing to the current during the tides. In this narrow strip of water during the tides there is a current ranging from ten to twelve miles per hour, which makes it very difficult for the planting and cultivating of this variety. Several attempts have been made, however, to imitate this oyster, and in some instances with fair success.

The Grand Bayou and Bayou Cook oysters, fat, healthy oysters of gigantic size, are also considered among the highest grades of oysters and bring a very good price on the market. These oysters compete favorably with the Ship Island and the Four Bayou varieties in excellence and cleanliness. They are found in abundance in the bayous from which they derive their names and are used in great quantities in Louisiana, Texas and Mississippi, being the chief raw oysters that are shipped to these points.

A small but excellent variety which brings a good price on the local market and scarcely ever is shipped out of New Orleans, never getting farther than the Louisiana line, is the Grand Lake oyster, which is found in comparatively small quantities in Grand Lake, approximately forty miles west of Grand Island in the Barataria Bay. These oysters are found in their primitive state, no effort having been made to any extent to cultivate the bottoms and reefs in this portion of the state.

Besides the finer grades found in the local waters are the Buras, or Supreme Bay oysters, which are gathered in unlimited quantities from Supreme Bay, near the Gulf Coast, on the east side of the river. These oysters are of a cheaper variety and furnished principally to the canning factories and local cheaper trade.

CONSERVATION OF OYSTERS

While there has never been any concerted movement toward the conservation of the local beds of oysters, the fishermen are becoming acquainted with the fact that although there is an almost unlimited supply of oysters, the beds must be conserved if the fishing is to go on indefinitely. To this end the fishermen are working, although the work of arranging the beds properly is hampered, owing to the fact that no aid is being given by the state or federal authorities.

The seed oysters, with which the beds are supplied each year, are gathered from beds on the east side of the Mississippi River about sixty miles below New Orleans. These seeds are transplanted to the beds where the best results have been secured. These beds are now being strewn also with oyster shells. For every barrel of empty shells scattered over the beds by the fishermen, in three years' time three barrels of oysters will be reaped as a harvest.

Dredging also aids greatly in keeping the beds in good shape. Too much dredging would prove fatal to the beds,

but under the present conditions the channels are kept clean of refuse, incidentally keeping this from infecting the oyster beds. Continual warfare, however, is always kept up between the dredgers and the fishermen for fear that the dredges will encroach on the oyster preserves and injure the plants. This, however, has very rarely been the case, and the oyster business at the present time is at its height.

THE OYSTER SHIPMENTS

From the local fields the state of Louisiana, Mississippi, Alabama, Oklahoma, Arkansas, Arizona and New Mexico derive almost their entire supply of oysters, while a great quantity of the local catch is shipped to Texas, Tennessee and California, the latter state being provided with only the best oysters that can be afforded by the local market.

The territory which is supplied by the Louisiana oyster is continually broadening, however, and every year brings a greater demand and necessitates more factories and shucking plants in the city and state. In the past fifteen years the oyster industries of Louisiana have broadened out by 60 per cent.

Together with the oyster fisheries come the kindred fisheries of shrimp, they being canned and shipped all over the country. The shrimp fishing, however, is more uncertain than the oyster fishing, being generally governed by weather. Shrimp travel in large schools and cover a vast area in a short time, being found in different places at different times. Although hard to catch at times, they are of an excellence and variety that only Louisiana can offer. Within a mile of where the salt-water shrimp, large and tempting, have been caught are found the smaller, sweeter variety of lake shrimp. These lake shrimp abound in bayous, canals and lakes along the southern part of the state, while the salt-water shrimp are generally found in the bays along the uneven coast.

OTHER FISHERIES

There are also to be found in the local waters the celebrated diamond-back terrapins, which, in recent years, have become one of the choicest of delicacies that can be found on the table of an epicure. A large and permanent fishery of these terrapins is located on Grand Island, owned by John Ludwig, Jr., who has been actively engaged in the terrapin industry for the past twenty years.

Redfish and other salt-water species of the finny tribe abound along the local coast and are caught and marketed in great numbers. These, however, are only sidelights of the real fisheries.

Alligators, too, are very plentiful in the bayous and furnish supplies for the California and Hot Springs, Ark., farms, where they are exhibited and where expensive and useful bags and furnishings are made from their skins. One establishment in New Orleans gathered several hundred alligators, ranging from the infants to older ones twelve feet in length. These are crated and shipped like so many cattle and bring a good price in a rather limited market.

THE PRESERVATION OF THE AMERICAN FISH FAUNA

By Henry B. Ward

It is hardly necessary to rehearse before this organization the early history of this country in regard to its treatment of the wild life, and especially the life of its lakes and streams. Not only the first travelers, but the early settlers for a century or more in its history found the waters everywhere teeming with fish of the finest types. There were incalculable numbers of these forms in lake and river and stream and pond. So great was the supply in the markets that the old indentures of apprentices provided that they were not to be fed more than once a week on such magnificent fish as the salmon and sturgeon, which now justly rank as delicacies and sell at prices that preclude their use by unwilling consumers. This ancient abundant supply is all but exhausted; for today the salmon has disappeared entirely from the Connecticut; the sturgeon and shad have become so rare in the Hudson and other rivers that the commercial fisheries have been largely abandoned, and they can hardly be said to belong in fact to our fauna.

Whereas our grandfathers insisted that the fish supplies of these waters were inexhaustible, we have found in fact, and within the limit of a century, that that wonderful supply has entirely disappeared.

Now, the preservation of the commercial fish became naturally a business matter and received as such, early and careful attention. By legal enactment there have been placed limits on the time of fishing, or the amount of the catch, or the size of the catch, limits which should serve to give the poor fish a chance. And when properly enforced these regulations proved helpful, but as population and fisherman multiplied many fold, even all these

methods of restriction were soon found to be inadequate to preserve the rapidly diminishing supply of fish, much less to restore that supply to its former abundance.

Efforts were next made to reinforce nature by hatching and planting young fish, and these methods were later coupled with the study of food, habits, and other conditions of existence that surround the life of the fish. A long campaign has been waged along these lines by series of efficient men in the United States Bureau of Fisheries and in the various state boards. It has yielded good results, and yet these results affect only a part of the great problem. The rest is left untouched. To appreciate the full scope of the question that is outlined in the title of this paper one must compare conditions which exist and movements which have been inaugurated in other parts of the field of nature and life.

One of the striking movements of recent years is the formation of wild parks or reserves. Areas have been set aside for the preservation of the native vegetation; state, county and city have laid out park and floral reserve until these areas can be found scattered from the Atlantic to the Pacific coasts in every state and almost in every county of the United States. Game reserves on wild land have been created for the preservation of the native mammals; other places have been set aside that wild birds might carry on their breeding without interference from the hunters.

All these movements have affected merely, or primarily at least, the higher forms of life, the birds and mammals. There is no doubt that the splendid series of bird reserves which has been created by the national Government is an effective aid in the multiplication of species almost extinct, and both Government experts and other workers in scientific fields now confidently proclaim that before many years these species will have re-established themselves in the fauna of the continent.

The problem as it concerns fish life is really much more difficult, because even for migratory birds it is sufficient to set aside a small breeding area and to give them free passage through the air from the points at which they spend one portion of their life to the point at which the breeding process is carried out. For fish it is necessary that a considerable stretch of territory, or even an entire stream, be set aside; and this adds to the expense and difficulties of securing and controlling the area. Yet it may confidently be maintained that such areas will be reserved for the propagation of the native fish and for the preservation of the fish fauna, just as they have been set aside for the preservation of the mammalian fauna and the bird fauna of the continent.

It is not so difficult to provide for the setting aside of short streams. This has been done for centuries in Europe and within recent years in Canada also. In United States territory it has been tried only to a very limited extent; thus in Alaska there are at least two prominent breeding streams of the salmon, which, by appropriate measures of the Government at Washington, have been reserved entirely from salmon fishing and preserved for breeding purposes. In some other places fishing is forbidden or greatly limited in particular lakes or in short streams or small tributaries.

But this is not the main feature of the problem to which I wish to call your especial attention. How do the fish fare on those protected areas which have been set aside for other purposes? What is the condition of aquatic life in the parks that have been reserved in order to preserve the native vegetation, to give breeding places for wild birds, and to furnish a refuge for the large game animals? The answer to this question is unfortunately not as favorable as might have been hoped. It is hardly necessary to call your attention to the fact that stream pollution is increasing; that its relation to these parks and areas is often distinctly unfavorable. Sources of stream

pollution originating inside of the areas, serve to reduce, often to destroy, the possibilities for aquatic life in the waters of those areas; and there are numerous instances which have been cited by writers familiar to you all, where such stream pollution originating outside of those areas has served to eliminate almost entirely the possibility of aquatic existence within the area of such a reserve.

Please do not misunderstand me. I would not intimate that in all or even a majority of such parks, especially those under national control, stream pollution has been permitted unreservedly; and yet it takes but very casual attention to ascertain numerous instances where such stream pollution is a real and serious matter. In other words, no adequate vigorous efforts have been made to control this factor, to correct the errors which have been made, or to keep the waters of such reserves favorable places for the breeding of all aquatic life. Surely we may expect that within the limits of national and state parks the water life should receive as careful attention as the life of the land or of the air.

In the next place a careful examination of the conditions prevailing in such areas will show perfectly distinctly that in many cases the fishes and the aquatic life connected with them are the only elements which are not subject to protection. It is possible to catch fish, or to destroy fish life, almost without reserve in some of these protected waters. You cannot pick the flowers, you cannot break the shrubbery or in any way injure the vegetation of the tract, but if you go fishing it is nobody's business; the fish have to look out for themselves!

Not only that, but I have been told on reliable authority that within state parks it is possible at times to see fish which have been caught in considerable numbers, and, not being wanted, have been thrown away to pollute the atmosphere, a senseless waste leading inevitably to

the complete destruction of the fish life within those waters.

Finally in this connection I would call your attention to a most important factor: the works of improvement, so-called, which have been carried out in these parks or reserves, have often taken a form which would tend to destroy the native home of aquatic life, and to render the natural breeding and living grounds unsuitable for fish and fish food. In other words, there is a great tendency to do what certain landscape architects call "cleaning up," a process which, when applied to waters, means the destruction of areas of limited depth and shore vegetation, and the modification of the natural surroundings, thus removing the shelter necessary to the development of the fish, as well as the food required for their growth, and often also taking away the available breeding grounds of the fish.

After this brief sketch of existing conditions, permit me to call your attention briefly to the needs of the situation in a definite and somewhat categorical manner.

The country should adopt a more definite policy looking towards the protection of aquatic life, especially the fish on the existing national reserves. The policy should be formulated by those who are the natural advisers of the Government in fish matters, the experts of the Bureau of Fisheries, and put into operation by agents either directly belonging to that bureau or at least approved by them. The evident difficulty suggests itself that some of these reserve areas are under the control of other sections of the Government than the Department of Commerce; but surely it should not be impossible to provide that the men who are made the guardians of those tracts should meet the approval of the United States Bureau of Fisheries as regards their knowledge of the situation and ability to cope with it, in so far as the fish and associated aquatic life are concerned.

In the next place, and more important still, similar action should be taken by all states regarding every state reserve, park or other protected area within its borders and under its control. The water bodies in such places should be preserved as refuges for all kinds of aquatic life, free from all sorts of attack. Stream pollution leading to the destruction of conditions favorable for aquatic life should be rigorously suppressed. It certainly is not too late in the newer states to stop this destruction of the haunts of our native fish, and maintain in a virgin condition the natural environment in some lakes and streams. Already one of the older states has learned the lesson that has been taught by a century or more of disregard for the condition of its streams, and is now attempting to restore natural conditions and to protect the streams from pollution.

In these state areas, definite steps should be taken to protect all kinds of fish found in the waters of these reserves, to give them all possible facilities for living and breeding and multiplying, to safeguard their continued existence and to provide, so far as possible, for their increase in number.

Finally, and most important, perhaps, of all, there should be the definite formation by national and state governments of fish preserves or refuges. These protected areas should provide not only for the commercial fish and their breeding grounds, but also for the other types of fish which are important biologically, are of interest to students of life, and are essential elements in the biological chain of relations that bind the commercial fish themselves back to the environment in which they naturally live. Here each state has its own natural problem. Within its state parks or stream preserves Colorado, for example, should keep the aquatic life of the mountains in its pure condition for future generations. Illinois should maintain in their natural environment the fish of the central prairie region. To Louisiana and Mis-

sissippi should be intrusted the duty of preserving the rich and varied fish fauna of the bayous and the brackish waters bordering on the Gulf. Each state and region has naturally some characteristic territory and hence its own proper responsibility in the problem of preserving for the future the varied aquatic life of the continent.

Comments are often made on the rapid and unfortunate disappearance of the game and food fishes as if they were usually the species that suffered most seriously or exclusively from the attacks of the rapacious fisherman or from the insidious influences of stream pollution and of changed conditions in the environment. For commercial reasons the effects on such species are best known, but there is ample evidence to show that they are not the only ones affected. I wonder how many of you know to what extent in some of the older states the small fish, the uncommercial fish of the waters have disappeared. A distinguished biologist, now curator of the Carnegie Museum at Pittsburg, in writing on this problem, says that the small streams of Western Pennsylvania have been almost entirely relieved of their original fish fauna, so that the little fish which formerly swarmed in every pool of their course can now hardly be found at a single point in their entire extent. The natural conditions for fish life are fast disappearing. If the original conditions are to be maintained for the future, even within limited areas, some definite and appropriate action must be taken immediately before everything is gone and aquatic reserves set aside, kept from the encroachment of commercial interests and from other unfavorable influences of increasing population and complexity of human life.

The influence of this Society should be exercised actively to bring about in some way the formation of such reserves. These "fish refuges" should be sometimes the head waters of streams, sometimes stretches in mid-stream, sometimes, let us hope, an entire stream,

sometimes perhaps only one of the individual lakes, or cutoffs, or swampy breeding places, or the back waters, or other aquatic conditions which afford a peculiar opportunity for the development of a certain type of fish fauna.

What can this Society do? Various organizations somewhat similar in general character have been successful in developing a series of bird reserves and a series of game parks under national and state auspices. Shall we acknowledge that we are less educated or less influential or less energetic?

DISCUSSION

DR. F. L. RISER, Henderson, Colo.: Reason and discrimination must be used in the matter of fish protection. The large fish eat the little fish. If we protect the big fish, the little fish will disappear. They have a law here punishing a man for killing a night heron and a blue heron. Yet they are the worst things I have to contend with. Those birds will destroy more fish in a night than I can carry away in a day. Then I think there should be some way of getting the largest fish out of the streams, and giving the young fellows a chance. A large trout will clean up a whole stream in a short time. I think that is one of the enemies of small fish that is sometimes overlooked. Most fishermen will get the little fish, but don't get the big fellows. There ought to be a way of getting the big fish out of the stream.

MR. C. H. THOMSON, Colorado: It seems to me a paper of this kind ought not to lack for somebody to speak upon it. The protection of our fish is one of the serious propositions which we have to contend with, not only the pollution of the streams, but the protection of our streams. Right here in Colorado the kingfisher, an arch enemy of the fish, is a protected bird of plumage.

As we are stocking our streams with small fish, we must not forget the troubles that small fish have with their enemies. Among these enemies are snakes. I could show you, if I had you in my hatchery at Estes Park, three fish over two inches long that I took from a snake's body before it had begun to digest them. The larger fish are living upon the smaller ones; it is the nature of all of our game fish. I took pity upon my pet fish in my hatching trough because I thought it was lonesome. This fish, a brook trout four years old, is so tame that I can take it out of the water with my hand and it will lie very quietly until I place it back into the water again; and I have shown it to 4,500 people. This year, as I say, I took pity on that fish because of its loneliness, and placed a yearling trout seven inches long in the

water to keep it company. I had been showing that fish in the morning to tourists at the hatchery, and I showed it again in the afternoon, but instead of exhibiting one fish, I showed my pet fish and the tail of the other sticking out of his mouth, one a three-year-old and the other a year-old, seven inches long; so in the stocking of our streams we should place the small fish where they are best adapted to the stream.

There is another proposition in regard to the protecting of our streams, and that is the protecting our streams from fish depletion by means of our irrigating ditches.

Now, gentlemen, that is a condition which arises in our irrigating districts outside of the eastern districts; our states in the west have that to contend with; and, gentlemen, it means just simply this: we will have no fish in our streams eventually unless we protect our streams from depletion by the irrigating ditches.

I am in rather a peculiar position here this afternoon and I will explain to you why. At this morning's session, if I understood rightly, Mr. Bower, from Michigan, stated in behalf of his own state that, with the exception of Colorado, Michigan could boast of the biggest fish liars. Now, I cannot understand why Mr. Bower should except Colorado and place us in the position of liars as fishermen. Judge Beaman took the floor a few minutes afterwards and said that the true sportsman and true fisherman of Colorado always told the truth. Now, gentlemen, you see what a position I am in. I wish you would give me the credit of telling the truth part of the time when I tell you the condition of the irrigating ditches and the condition of our streams. I will only give you statements that I can verify.

Last season the report came out in our paper from North Park under the heading of farmers fertilizing their ranches with our mountain trout. That looked like a pretty hard proposition. I can verify by eye witnesses that these trout were drained out by irrigating ditches onto the hay fields. The larger ones were taken for use and the smaller left there to rot in the sun. These fish had been placed in the streams by our fish commission. This is not only a condition in Colorado, but it prevails in Wyoming and other states where irrigation is going on.

MR. DANIEL B. FEARING, Rhode Island: I think the gentleman is wandering from the subject; he is talking on stream pollution.

PRESIDENT: I think Mr. Thomson is talking on Dr. Ward's paper, on the saving of the fish.

MR. THOMSON: I do not desire to speak only as I am speaking upon the paper, and I understood Professor Ward's paper was on the protection of our streams; I desire to go a little farther along this line. While I will mention no names, I think this statement can be verified, that in many instances the water is turned out of the ditches at night, where arrangements have been made beforehand, and then turned on before daylight, and the fish are taken for table use. There is no

protection against this wrong to be secured at present either from the state or national Government.

PROFESSOR WARD: I cut out part of my paper. Perhaps it was not entirely clear. Undoubtedly my method of expression was not always such as to bring it positively before your minds. For two remarks made by those who discussed the paper did not seem to me to meet the conditions set forth in the paper. I believe in saving the small fish and the large fish, and I am confident, if we are going to save any part of our native fauna, we must save the birds or some of them; and if we save them we have got to let them eat. But if you preserve a stream in its natural condition, not straight banked and clean bottomed like a reservoir, but with the inequalities of bottom and the protection of cover at the shore that you find in a natural lake or in a natural stream, if you have such places as we have all seen in Colorado, where the logs have drifted down and the sticks have jammed together until no bird could get through there, and if you have places where the rushes are so thick and the moss, if I can use that term, so abundant that the big fish cannot get in there, then your little fish will get out of the way of both the big fish and the birds, and the birds will have some fun hunting and the big fish will have some fun hunting, and the little fish will have some exercise getting out of the way. What we need is to preserve a little territory in an absolutely natural condition, not cleaned up and modernized, but just as it would be in nature and suitable for the protection of the fish of every size.

C. K. CRANSTON, Oregon: My chief object in coming here was to learn. I understood the nature of the paper was the description of the conditions which prevail all too largely and to the change which has unfortunately come about in the condition of our streams from the natural condition to the present. What I would like to hear is suggestions of a practical nature whereby we may hope to improve those conditions, and to come down to brass tacks, so to speak, as to what we can do or suggest, to bring about a change of attitude on the part of the average community towards the pollution of our streams by the introduction into them of factory waste; and more particularly and specifically the correction of the trouble, that is almost universal, of the running of town and municipal sewage into water courses. There is the meat of the whole proposition, to get rid of that; and if there can be any suggestions made that will help me in the campaign that I am trying to institute in my state to correct that condition, I want to hear them.

PRESIDENT: I think Judge Beaman's suggestion last week was a grand one. He said we had the law already; what we need is its enforcement.

MR. CRANSTON: We have law enough, but it is necessary to get public sentiment to support the enforcement of the law.

PRESIDENT: I understand from Judge Beaman that any citizen can take this matter up by going to the attorney-general of the state and having a suit instituted. I did not know that until yesterday.

MR. CRANSTON: I am advised by one of the members of the State Board of Health in Oregon that it is not the lack of law; the difficulty is that in order to bring action to enforce these regulations you have got to bring action against the people themselves. You know what that means.

MR. NATHAN R. BULLER, Pennsylvania: I represent a state that has more pollution to the square inch of water than any state in the Union; and our laws covering that question are very good. We have a Department of Health, and not a Board of Health, but the Department of Health is ruled over by a Commissioner; his title is Health Commissioner of the Commonwealth of Pennsylvania. He has jurisdiction over all sewage from towns and cities in the Commonwealth; and while the question is one of great magnitude, he is working along these lines, that each town and each city will be compelled to put in plants to take care of their sewage, instead of running it in the public streets, as is done in a great measure at the present time.

I consult with him very frequently. It is not a problem that can be solved in a few weeks or a few months; it is a long-drawn-out question, and in these few years his department has been created he has done great work.

Now, a great many of these towns and cities at the present time are burdened with heavy debts, and it is a very hard matter to get them to issue bonds to build these plants; but it will all come; each town will be compelled to do it. This Health Commissioner, I might say, has unlimited means at his command to bring these matters about.

The Department of Fisheries has jurisdiction over the pollution of streams from manufactories, of which we have about 47,000 in the State of Pennsylvania that are running refuse into our streams at the present time. Such small problems as arise from the pollution of streams from sawmill refuse and wood alcohol and acid mills, are very easily solved; a great many of the acid plants today that are located on our streams are putting in plants that take absolute care of their pollution, so that in a very short time there will be no pollution in our streams from that source.

With the tanneries, of which there are quite a number, I have taken this course. I find, on investigation, that there is not much to be gained by sporadic attempts upon them. If you take a case here and there, there is not much accomplished. But in order to accomplish some results and eliminate this pollution, united action is necessary. I am shortly to have a conference with the representatives from every tannery in the State of Pennsylvania, and they as a body will work out some definite plan that each one is to pursue. With our paper mills we have the hardest proposition that presents itself, on account of the great amount of water that they use in the manufacture of paper; but it is a fact that I have visited paper mills on the Clarion River, which is a river so polluted that even a typhoid germ will refuse to live in it; and these paper mills are spending thousands of dollars

each month to clarify the water in order to make a good paper, where somebody else has polluted the water above them; and then they run their refuse into the stream for the next man below to clean.

Now, I think if these manufacturers all get together there could be some definite plan worked out which would be successful; for the money that they are using today for clarifying this water would be spent in the effort to keep this pollution out; and then some results will be obtained.

Pennsylvania is working along those lines; and while it is a long-drawn-out question, I believe the time is coming when our streams will be purer by far than at present; but it will not be done in the course of six months or a year.

With respect to the matter of running off sand and waste from quarries that is a subject entirely taken up by a commission, called the Water Supply Commission; and a great many specific complaints that come to the Department of Fisheries on that line are turned over to them and given attention by that commission.

These are the efforts that are being put forth in my state looking towards securing the purification of the streams.

MR. ERNEST SCHAEFFLE, San Francisco: Has any one found a way of handling paper mill refuse? We have had trouble with a mill at Floriston near the Nevada line. The only way we can think of is to shut down the paper mill, representing an investment of a million dollars, with a pay-roll supporting the entire district. Has any one any remedy to suggest for a problem of that kind?

MR. CRANSTON: In Oregon City there is a paper mill having vats discharging into the Williamette River. It is a great nuisance. But we have secured the installation of a large settling tank for this pulp waste, and we have thus got around a good deal of the trouble. It has not entirely cured it, but has improved the condition perceptibly.

MR. SCHAEFFLE: That is in a place where they have room for settling vats. This mill is in a deep canon and there is no room to settle anything.

MR. BULLER: Are your paper mills sulphite or soda?

MR. SCHAEFFLE: Sulphite.

MR. BULLER: In several paper mills that I have gone over they are using large sedimentation beds to precipitate the lime and soda; and a great deal of their refuse is burnt up by being run through a hot retort.

MR. SCHAEFFLE: That is evidently a pulp mill.

MR. BULLER: I have found that 90% of all these manufacturers are perfectly willing to take care of this refuse if they are shown a way how. But to gain results we must first get some definite plan to work upon.

MR. SCHAEFFLE: These people will spend any amount of money, if I can tell them what to do.

MR. BULLER: We find the same thing. But they do not feel like abandoning their plants or spending thousands of dollars without gaining some definite benefit from it.

MR. SCHAEFFLE: Naturally.

MR. BULLER: A great many contrivances are used which are successful up to a certain point, but when they reach that point it is as bad as ever.

MR. SCHAEFFLE: I would like to say also that in San Francisco, where we have only one gas light plant, making 15,000,000 cubic feet a day from crude oil, that we have at last effected a means of restraining the lamp black, oil, tar and other products that went into the bay for 40 years. The gas company has spent $75,000 in constructing a filter plant which is now in operation, that not only saves this waste, but makes a valuable by-product from it. They are making briquettes from the lamp black in which there is enough tar to act as a binder. The same company is working on a new process of manufacturing in which there will be no waste product; the entire body of petroleum will be made into gas, although there may be a very slight amount of coal tar left. That was the worst problem we had at San Francisco Bay for 40 years. From the work that our chemists have done during the last year, it appears that in addition to the thousands of tons of lamp black and coal tar that have been poured into the bay, about one million pounds of cyanide of potassium has gone in along with the other material. But we have not found a way of restraining this cyanide, which is still going in with the wash water.

MR. BULLER: For the benefit of any member here, in states where there are acid of wood alcohol plants, I might state that at a plant that I examined a short time ago I found the system in use that absolutely prevents any pollution from getting into the stream. A couple of years ago they ran all the refuse into the stream, and destroyed the fish in the stream entirely. Today, by eliminating that refuse, the stream is being restored as a good trout stream again. The makers of the apparatus are Rieser & Sons, Tanners' Falls, Pa. Their system of taking care of this refuse is that after all the grease is taken out of their vats the refuse that ran in the stream before, which was a black substance about the consistency of crude petroleum, and very hard to handle, is run into large boiling vats and boiled down to a consistency where they can shovel it, and they now use it in their furnaces; and while they are not making money, it is paying them to use it as fuel; and there is absolutely nothing going into the stream but the steam that condenses in these vats; and I have requested every acid manufacturer in the State of Pennsylvania to do likewise, to boil their waste and use it in that way.

MR. SCHAEFFLE: How do you handle the waste wash water from petroleum refineries in Pennsylvania; I refer to the wash water containing sulphuric acid?

MR. BULLER: There is a question that I have not had time to go over carefully. I have not been in the oil regions up to the present time to investigate their waste; that is quite an extensive territory. While most of the sulphur water is running into waters where mines are situated along the streams, I have not been into that territory as yet. But the question is becoming one of such seriousness in the State of Pennsylvania in certain portions that the manufacturers themselves along the western waters are realizing the fact that this pollution must be taken care of in some way, on account of their boats, engines and every other thing that they use in the water. The Engineers' Society now are trying to devise ways and means to get rid of the water from the mines.

MR. SCHAEFFLE: I would like to warn any of you gentlemen who may come from the states in which oil refining is carried on, that something which a great many of us did not suspect, in looking for oil itself, is a very serious problem. I have found one refinery in California that empties as much as five tons of dilute sulphuric acid into the waters of our state every day—from five tons down to three tons, greatly diluted with salt water; and with this some 16,000 to 36,000 pounds of sodium sulphate are emptied into the streams. We have not found any way of preventing that waste. The acid as it comes from these stills, I presume, or the washing chambers, is in such very dilute form that there is apparently no way of separating it. It is out of the question to dry up the water or volatilize it. We are letting that go into the water and out into the bay until we can find a way of controlling it.

PROTECTION OF THE UNDERSIZED FISH

By G. H. Thomson

My paper will be mostly a summing up of the work performed during the last four years along the lines of education and protection.

The action which the American Fisheries Society took at its meeting held in Washington, September 21-24, 1908, when it recommended that the various state commissions educate the people by every means in their power to follow the directions given on my post card, which reads as follows:

A PLEA FOR THE FISH

When removing an undersized trout from your hook, always moisten your hands before grasping the fish; otherwise the dry hand will remove the slime from the back of the trout, when it is only a question of time until fungus sets in and the fish will die.

Always kill your fish that are large enough to keep, as soon as taken from the hook. This can be done by giving it a stroke with a stick on the head, back of the eyes. It will avoid all suffering, and make your fish far better for table use.

The American Fisheries Society, at Washington, D. C., September 21-24, 1908, recommended that the various state commissions educate the people by every means in their power to follow the directions given about wetting the hands.

Indorsed by twenty-eight fish and game commissioners throughout the United States.

G. H. THOMSON, FISH CULTURIST,
Superintendent of the Estes Park Fish Hatchery.

During the winter of 1908-1909 I took the matter up with every game and fish commissioner in the United States, asking for their endorsement of the directions. I secured the approval of twenty-eight. Many of them asked for the privilege of reprinting them for their use, which was granted.

I have used the press as a means of education. Many editors, just before the opening of the fishing season, have used the card as a standing advertisement for the

protection of the fish which have to be returned to the stream. I have taken the matter up with our railroad officials, asking that, as they issue their printed matter for the tourist season, they insert my card. All have very kindly granted my request, and in this way fishermen are reached who would not be otherwise.

The subject has been taken up with fishing clubs. Some of them are printing the directions on the back of their membership cards.

I am distributing the card to visitors at the hatchery, to whom I show the fish which brought forth the publication of the card and which I saved from death from fungus by my treatment. Last season I had the card printed in the form of post cards, which I have given out at the hatchery as free printed matter. By this means I have secured for it a still wider circulation.

The subject has been taken up in the public schools as an object of instruction, and it should be taught in the schools. Why should not the coming fishermen be educated along the lines of fish protection? Our game laws in Colorado provide that all fish taken under seven inches in length shall be returned to the streams, but they stop right there and give no instruction as to how to handle the individual fish so that it may have an opportunity to live after being returned to the water.

In order that I might know something about how many people I have instructed as to the handling of the undersized fish, and also to whom I have exhibited my pet fish, I opened a register on the 25th of May, the beginning of the open season for fishing, and up to the 2d of September my register contained the names of 4,550 people. I have given out over 3,000 cards containing my plea for the undersized fish, also about 2,000 post cards with the same instructions.

My register contains the names of persons from China, France, Honduras, British Columbia, San Salvador, and from nearly every state in the Union. While the recip-

ients may lose their cards they will never forget the instructions on protection given at the hatchery.

When we take into consideration the time and care that it takes through artificial propagation to bring one of our trout to the fishing limit of seven inches, and that one grasp of the dry hand, in taking an undersized fish from the hook for returning it to the water, removing nature's protection so that the fish will die after being returned, it seems to me that the American Fisheries Society should push the matter of education for the protection of the undersized fish as far as possible.

DISCUSSION

I would like to take a few moments' time in demonstration.

(Mr. Thomson here produced from a wooden box a sealed tube of glass about one-half inch in diameter and about four feet in length, containing specimens showing the various stages of growth of the fish.)

I can give you an exhibit here in this tube, of the stages from the time the eggs are taken from the fish until the fish are ready for the stream.

In our hatchery in Estes Park, the water stands at 46°; and it changed but two degrees last winter.

We take the eggs after they are fertilized and place them on the hatching trays, and they will require 40 days to reach the stage shown in this glass tube, when they are hatched out.

From the time the eggs are placed on the trays to the eyed stage, which is the stage when the Government do their shipping, it will take 25 days in a temperature of water standing at 46°. At this stage they can be packed in moss and kept at a temperature not colder than 38°. When the Government ships eggs to Japan and Australia, they ship them in the eyed stage.

You will see from the tube that after 35 days much greater progress is shown, and you can see the fish curled up.

In 40 days you will see the fish as they have passed from the egg state to the absorption state. There is a spot on the shell of the egg where each fish has passed through, as you will see in the tube.

Ten days after the hatching out you will see them at this stage. Then in 20 and 30 days they rise to hunt food. You will notice the development in 20 days and the further development at 30 days.

You will see here then the whole process of development, from the time the eggs are placed on the tray, until they rise to hunt for food, when we begin feeding them.

The best authorities which we have on the culture of trout say that only 3% of the trout reach that stage.

With ordinary care in passing through the hatchery, we will place out in the stream 75% through artificial propagation.

Now from this stage of feeding, on an average, it will take our young fish 15 months to pass the 8 inch limit.

When it takes that much time and care to raise a fish, it seems a shame to destroy that fish in returning it to the stream by handling it with the dry hand.

You will notice here something of the deformities found in fish during development, showing double fish and double-headed fish. As they reach a certain stage and as they absorb the yolk, they die; so you never find a double fish in the stream.

You will notice from this specimen which I show you, the cannibalistic nature of the trout. You will see the tail of one little trout sticking out of the mouth of another. There is no show for the weaker fish in the hatchery.

That will give an idea of the time it takes to bring one of our fish from the egg stage to the fishing stage.

I brought these exhibits, simply to demonstrate the time and the trouble which it takes to raise trout.

I have had fishermen say it is too much trouble to be careful in handling these undersized fish. But they are not sportsmen, for they are unwilling to take the trouble to protect the undersized fish; and if a man has not sufficient interest in the undersized fish to protect it after he has caught it, then I say he has no business to fish along our streams. (Applause.)

PROFESSOR DYCHE: I think, in order to make an experiment of that kind of value, and in order to give value to ideas such as those put forth by Mr. Thomson, the experiments ought to be performed on rather a large scale. I myself have subjected a hundred or more fish to certain kinds of treatment. While experimenting we handled fish with wet hands and with dry hands, and also scratched them with small sticks and stems of grass and leaves, then they were placed in ponds and we watched for results. I am not quite ready to report on just all the things that have happened to those fish; further experiments are necessary. The trout are not perhaps any more liable to be affected by this fungus than many other kinds of fish. Catfish, bass and crappie, in fact nearly all kinds of fresh water fish, are more or less liable to be affected with this fungus disease. We have certain rules that we observe when we handle fish at the hatchery. My idea about the trout business would be to experiment on a large scale; a hundred or more fish should be used and the experiment performed at different times and under different conditions.

Fish culturists know that the white fungus is a disease that injures fish. Only exact experiments properly conducted will add to our present knowledge. Handling a fish with the dry hand may start a fungus

growth on it. The wound inflicted by the hook in catching the fish may also start a growth of fungus even though the fish be removed from the hook with a wet hand.

I really think that before this Society could very well pass upon a thing of this kind and make recommendation to men all over the country, that it might be well to have experiments performed on a more extensive scale than with one, two or three specimens of fish under restricted conditions. I should think 100 would be a fair number to work with; that number would give an idea on a percentage basis easy to understand. If fish are taken that have suffered injuries in various ways, by the hook, the seine, or the hand, for instance, and placed in water under natural conditions and studied for several months, then one might get a fair idea of just what would happen to the fish.

Mr. Thomson is undoubtedly right in his statement that if you take a fish in your dry hand and rub the slime off, that it will injure the fish; however, we should like to know the percentage under different conditions, and that would require an examination of a large number of fish.

Another thing that should be borne in mind is that, that taking a fish off the hook in your hand and putting it back in the water is only one of the things that happens when a fish is caught on a hook. The ordinary fisherman pulls the trout (or other fish) out of the water, and before it is landed it turns three or four somersaults, lands in the bush or on the ground or rocks and gets generally bruised up before the fisherman ever touches his hand to it. Many other injuries besides those inflicted by the dry hand may cause fungus growth on fish.

MR. THOMSON: I do not think Mr. Dyche quite understands my position. I did not ask for recommendations from this organization on that proposition. My paper was simply a report upon the position this organization took in 1908 in Washington, when they recommended that the various state commissions educate the public as far as possible in the wetting of hands. Our trout is quite different from the fish in warm water streams. You remove the slime from the back of our trout and you remove nature's protection.

MR. DANIEL B. FEARING, Rhode Island: I would like to relate an experience which I personally had. I happened to be chairman of the oldest trout-fishing club on the island of Long Island in New York State; and we have the finest wild trout fishing that there is in New York State. We have only 15 members in the club. We have about seven miles of the Connecticut River, so-called, running through Long Island; and we never keep a fish weighing less than half a pound; we throw everything else back. We always fish from boats, and the boatmen are always instructed, and they always do wet their hands before handling fish.

Some eight years ago I started an investigation on my own account, and I got a conductor's punch that was made very small and very

sharp; and every fish that I threw back, the man wet his hands before the fish was taken off the hook, and a small hole was punched either in his dorsal fin or tail, and I threw back that fishing season between 480 and 500 half-pound fish, and not a single one of those fish was ever seen again—was ever taken again. Now, those fish we handled as carefully as possible with the hand wet; and they were only thrown back if they were not bleeding in the mouth and were not badly hooked, and the hands were always wet before they were thrown back; they were treated with the kindest consideration possible, and yet not a single one of those 500 fish was ever seen again.

MR. ERNEST SCHAEFFLE, San Francisco: Is it not possible that the markings had regenerated?

MR. FEARING: Did you ever know of a case of a fish generating a tail which had a hole punched in it?

MR. SCHAEFFLE: They do regenerate in California.

MR. FEARING: It is not supposed to be possible.

MR. SCHAEFFLE: That has been our great trouble, and we have marked salmon and trout.

MR. FEARING: They mark salmon in England by a silver wire. I will ask Professor Ward: Is it not supposed to be impossible for a fish to regrow an attachment of that sort?

PROFESSOR WARD: I cannot say with respect to those fish.

MR. FEARING: Did you ever hear of trout or salmon that would grow a tail after one had been lost?

PROFESSOR WARD: I do not know of experiments on salmon and trout. As far as I know of such mutilations they remain unmodified.

MR. FEARING: Do you known personally of a trout or salmon being marked in that way?

MR. SCHAEFFLE: Yes, we have done that. These marked fish have been held in troughs and special ponds, and we have watched the fins regenerate.

MR. FEARING: I never heard that in salmon and trout.

PROFESSOR WARD: Your statement is that none of those fish have ever been returned. Is it not probable that they may have been taken and not reported?

MR. FEARING: No. A careful record of them has been kept. This is in a private club, and everything was marked, and watched, as I said.

MR. THOMSON: How were those fish marked?

MR. FEARING: With a perfectly clean-cut round hole right through the dorsal fin or the tail. I would like to inquire from Mr. Schaeffle the source of his information.

MR. SCHAEFFLE: I have taken my report from an employe who is in charge of fish cultural work in California.

MR. FEARING: Then your information is not based on personal examination?

MR. SCHAEFFLE: There is no doubt of the fact.

MR. CRANSTON: Is it your opinion that a mark in the nature of a hole cut out of the gill cover, would be an enduring mark sufficient to identify fish at any time thereafter.

MR. FEARING: I did not refer to the gill cover; but to a round hole cut in the fin or tail. Could such a hole unite. Perhaps the tail will grow, but will not the hole remain?

MR. SCHAEFFLE: We have experimented with marks on the rainbow, the steelhead and the salmon.

MR. FEARING: Is it true that you found the only way of marking salmon was with silver or copper wire?

MR. SCHAEFFLE: That is what we are doing.

MR. THOMSON: In my hatchery the fish lost the entire fin; if that fin had been marked it would have been lost. There was not a thing to show for it. The caudal, dorsal and pectoral fins come right off close to the fish's body.

MR. FEARING: Then you idea is that in the case of a fish marked in that way, nature would make it lose the entire fin or tail?

MR. THOMSON: Yes.

MR. FEARING: That would explain the thing.

MR. THOMSON: I had several fish there at the time, and they were all cured of fungus growth.

MR. FEARING: We have cured any number of fish of fungus by putting them in a salt water bath, and we do that as a rule.

MR. THOMSON: That is proper. I have not marked the fish that way; but it would have disappeared anyway.

MR. FEARING: That would explain the fact that we never saw them again. It has never been brought up to my knowledge.

MR. THOMSON: I know absolutely; I have watched the thing right through. There was not a thing to the fish; it was a bobtailed fish.

MR. FEARING: Then your idea is that they grow new fins as a lobster grows a claw.

MR. THOMSON: Why shouldn't they—just as a bird will grow a new claw.

MR. FEARING: It is very interesting. I never heard this view taken before. No one seems to know of it.

MR. THOMSON: I am speaking of my own investigation.

PROFESSOR DYCHE: You have suggested some very remarkable things in connection with the moulting of the fins of the fish. I have been looking through fish literature and making experiments for a lifetime, and this is entirely new to me. It is so new and interesting that I would be glad to come out and spend a month or two with you and have you help me to perform some experiments.

MR. THOMSON: I give you a standing invitation to do so.

PROFESSOR DYCHE: I am building a laboratory for carrying on investigation; but I cannot handle trout in my laboratory.

MR. THOMSON: Trout in cold water streams are quite different from fish of warm water streams.

PROFESSOR DYCHE: I do not know anything about trout.

MR. THOMSON: Take trout in water warmer than 74°, and these trout will live longer in the grass than in the water.

MR. DYCHE: I should like to see some experiments carried on in this line.

MR. THOMSON: I should be glad to cooperate with you. I have had considerable opposition on that line, but not with fishermen. There is a difference between fishmen and a fisherman. Some of the oldest fishmen in this state came out bluntly and said the whole proposition was bosh. One of these fishmen said that he had been in the fish business 25 years in Colorado and had handled hundreds of thousands of pounds of fish and had never found that condition to exist; and that if it did exist, our fish would die by the thousands. But he was speaking from the fishman's standpoint, when in the spawning field they were taken out of a tub of water, and the hand was wet, and not from the fisherman's along the stream when the hand is dry.

MR. S. E. LAND, Denver, Colo.: As I understand it, in the case of a fish taken without moistening the hand, the mucous is removed, thus causing fungus, and the fish shed their fins because of the fungus.

MR. THOMSON: That fish shed its coloring from the treatment I gave it; it lost its fins and every particle of coloring; it was strictly a white fish.

MR. LAND: To what do you attribute it, to the removal of the mucus on the fish from the handling with dry hands?

MR. THOMSON: I can answer that in this way: When a bird loses its feathers, it has nothing to protect it. Now the protection of that trout was the slime on its back—nature's protection—and the use of your dry hand, contrary to the order of nature, will remove that protection.

MR. LAND: When Dr. Bean was Director of the New York Aquarium he gave me a demonstration of how he cured fish from which the mucus was gone through injury or fungus. He used salt water from the ocean.

MR. THOMSON: I have used peroxide of hydrogen—just raised the fish enough out of the water to pour peroxide on it; and I have thus destroyed the fungus and saved the fish.

MR. LAND: I am like Professor Dyche; I want to have a scientific demonstration of these things. But I admire Mr. Thomson for the step he has taken in regard to the protection of the undersized fish.

I am operating now on the Cottonwood Lakes in the Grand Mesa of the Colorado. I have had bills printed on cloth, using the very statements that Mr. Thomson makes on his cards. Its effect in the education of the people has been very marked, and they are all handling their fish with much more care. It is a grand and humane thing to have undersized fish returned to the water without injury.

It is important also to get people to act in cooperation with the boards of health, by being careful to avoid throwing entrails of fish, or washing fish in the streams. On the Cottonwood Lakes we are earnest in our endeavor to educate people along the line of keeping the waters pure.

WATER POLLUTION

GEORGE W. FIELD

When Colonel Acklen referred to the pollution of the streams of the United States, I felt that he had struck the keynote of the meeting. This is one of the most important problems before us, both as citizens and as commissioners. The condition in Massachusetts has been acute for many years. Two years ago a law was passed by which it was absolutely forbidden to place in the streams of the Commonwealth sewage, manufacturing waste, or any material whatever which in any way, directly or indirectly, could be prejudicial to fish life, and by that I mean not alone injuring the fish but injuring the food—the microscopic plant or the microscopic animals in the water upon which the fish depend in any degree. Now, as a result of the conditions there, two very important decisions have been made by the courts, which I feel are of very great value to all of us, not alone to the citizens of Massachusetts, but to the citizens of the United States. Of the two hundred and more cases upon which we have taken action, only two have been appealed from the decision of the lower court. One of these went to the Supreme Court on the grounds that the defendants had been putting this polluting material into the streams for upwards of 200 years; therefore they claimed that they had gained by prescription the right to continue the pollution. The Supreme Court decided specifically that no individual or corporation could acquire by prescription such a right against the state; that the fact that they had not earlier been prevented from putting this material into the stream was no reason why they could not be so prevented at any time.

The second case is equally interesting and important from another point of view. When the issue arose as to what constituted the "fisheries value" of the stream, we were di-

rected by the Chief Justice to consider not alone the present value of the fish which could be taken from that stream, but the potential value of that stream, what it could be made to produce in fish for food, and in addition we were to consider the recreational value of the stream as a beauty spot.

We do not contemplate a rabid agitation or any ill-advised attempt to force manufacturers to do anything prejudicial to their real interests, but we believe that in the course of five or ten years some very progressive steps will have been taken.

Very strong pressure was placed upon the Governor when the legislative act came before him for approval. He had fully made up his mind to veto the measure; when he called me in consultation, I directed his attention, among other things, to the fact that Boston, by turning its sewage into the harbor, was destroying an annual value of over $400,000 worth of shellfish each year. Now, that is but a fraction when compared to the waste and destruction wrought by the mill waste and other material that goes into the Blackstone, Merrimac and Connecticut Rivers, and the myriad of smaller streams, not to mention numerous state ponds.

In this connection not alone must we consider the actual value of the fish life rendered impossible, but in addition the waste of an inconceivably vast amount of valuable material which should be used for fertilizing the land.

We have made experiments and observations which indicate that this material, if placed upon the land, will be turned into plant food in the quickest possible manner; if placed in the fresh water streams, it changes to plant food somewhat more slowly; if placed in brackish water, considerably more slowly, and if placed in salt water, very, very, slowly. There, instead of being turned into plant food, it is rapidly precipitated and drops to the bottom as a slimy sludge, which will be of practically no value as plant food for years and years to come on account of conditions unfavorable to oxidation and nitrification.

Looked at in a very large way, what are we doing all over the United States? We are collecting water which formerly spread over and irrigated the ground and conducting it in closed pipes down to the cities. I am speaking more particularly of eastern cities. Thus in Boston and New York inconceivable quantities of water are diverted from the natural use and brought prematurely, so to speak, to the ocean, without doing the work which was its original and natural function.

In addition to that we are diverting this material which should go back to the land as a fertilizer, and which as sewage variously mixed and modified is in Germany, at Berlin, and other places, used for irrigating and fertilizing the land. This land is rented to the farmers for $30 or $40 an acre, or practically the same price which farmers pay here for water privileges on irrigated land. That fertilizing and irrigating material is turned into the ocean prematurely can mean nothing eventually except a vast destructive economic waste.

I do not believe we are in position immediately to overturn all our systems and ideas of sewage disposal; but the time is coming when we must use this material on the land for irrigating and fertilizing purposes, and we must use and maintain the waters in a condition suitable for the development of the fisheries.

We had in Massachusetts the salmon fisheries, shad fisheries, alewife fisheries and smelt fisheries of a value of upwards of half a million dollars annually, which are absolutely destroyed by this indecent method of sewage disposal.

THE BLACK-SPOTTED MOUNTAIN TROUT

(Salmo stomias and related species)

By S. E. Land

Introductory comment by the reader.

Before I read my paper I would like to make a few remarks on the paper that our worthy President, Mr. Fullerton, brought up at the St. Louis meeting. The food problem regarding trout, and the question now before us of how we shall raise the standard of the domesticated trout, are important. The problem is, how can we make them produce a progeny equal to that of the wild trout? I have on exhibition here trout that have been introduced in the State of Colorado from California. They grow to great size in our waters, in our cold streams fed apparently by snow water, especially in the month of June, and there the development of the eggs is retarded, because they are transferred from California, where in their natural habitat they reproduce in February and March, and in our icy elevation of ten thousand feet they do not reproduce until the latter part of June and up to the 10th of July, keeping their reproduction of eggs back for five months. Nevertheless they grow to a great size. This first trout which I exhibit was caught in the southern part of the state by a man present here today, from Elbow Creek, that empties into Electric Lake twenty miles from Durango. I helped land that fish. From that lake we took two million eggs of the rainbow trout. This second trout was taken from the headwaters tributary to the Rio Grande from Charles Mason's Lake. It is a cutthroat trout with the fine spots (*Salmo spilurus*) and is known as the black-spotted mountain trout. We have also the black-spotted mountain trout with large spots that lives in the higher waters of the mountains and never moves from this environment.

The first fish weighs about ten and one-half pounds, and the second five pounds. The second one is from the lake, from those waters that run down into the Rio Grande.

This third one belongs to an introduced species, *Salvelinus fontinalis,* and is from a lake somewhere in the Rocky Mountains here; but they grow also as heavy as five pounds in lakes, and they do not grow more than half that size in the rivers, and much smaller in the smaller streams. They also retain their size and beautiful colors as they are brought from the New England states or Pennsylvania. The habitat of the last trout (*Salvelinus fontinalis*) ranges from Georgia all through the Allegheny Mountains, Pennsylvania and up to the British possessions. The first one is from California, and the second one I will refer to in my paper.

I have also a specimen which, after I get through my paper, I will refer to.

In regard to the food of the trout of the Rocky Mountains I have samples preserved so that you can see what the trout live on, and I will say that the same aquatic insects destroy the eggs and the young of the trout.

The species is distributed throughout the inter-mountain states. As stated by Dr. Jordan: "It was born in Alaska and has worked its way southward and eastward into the streams of the great Rocky Mountain region. It is one of the handsomest and finest, yet it has rarely been transplanted to waters of other than those to which it is native. This trout is usually known as the 'cut-throat' trout, from the half hidden gash of deep scarlet which is always found just below the base of the lower jaw. Other marks are the rather long head, which forms nearly the fourth of the length of the body from the snout to the base of the caudal fin. Almost always there is a narrow line of very slender teeth along the middle lines of the base of the tongue, besides the larger teeth, which surround the edge of the tongue in all trout. The body is usually well spotted, and the spots are a

good size on small fish and finer on the larger ones, there being none on the belly. This species is the most widely distributed of the trout."

The State of Colorado has devoted a great deal of time and money to the rearing of this species, as well as to the introduction of the brook trout of the east, and the California rainbow trout.

In 1882 the brook trout were hatched and distributed in a small way here; and in 1886 the eggs of the McCloud River rainbow trout were secured and hatched in what is known as our Denver state hatchery. These fish were introduced in the Platte and Gunnison rivers of the state. A few years later the eggs of the Green-back or Arkansas trout (*Salmo stomias*) were first taken from fish found in Twin Lakes near Leadville, of this state. Since that time, the collection of eggs of the native trout by what is known as "field work" has extended to most every part of the state, taking in from eight to ten large lakes and reservoirs. With the improved method of taking and handling spawn of the native trout, we now collect from ten to fifteen million eggs annually.

This species should be handled with great care, to save the fish from injury, as well as to prevent the loss of eggs. According to the temperature of the water the milt dies from three to five minutes after it is taken from the fish. Fish eggs should not be taken in water in a pan of expanded eggs covered with water, or in floating dead milt. This is done by the novice too often; by our method of wholesale collection of eggs from wild fish. Nevertheless, we pay for it dearly by having to pick out a large percentage of these unfertilized eggs at the hatcheries. Another thing I would call attention to the fish culturist is, that we find on examination of these trout that you cannot take the last few eggs from them, as a few eggs are in the same condition in them at the upper end of the ovaries as all eggs are in the roe in an unripe fish. That is, they are connected by little blood vessels,

and when forced from the fish by a novice with continued stripping are released and appear like the other eggs, but they are immature, and cannot be fertilized. This adds more useless or dead eggs to the hatchery work. More important yet is that the parent fish die and thus diminishes each year our annual output of eggs.

We are now more fully utilizing the lakes and reservoirs as a source of supply for eggs that the fry hatched from them may be used for stocking barren and depleted waters. We are not relying on our streams as heretofore in the collection of eggs from wild trout.

Packing and Shipping

Packing and shipping green eggs of the native trout from the field stations to the hatcheries requires great care from start to end of destination. Packing the eggs consists in placing them in cases, which are shaped so that they can be put on pack-horses, each case holding one hundred and sixty thousand eggs. Each horse can carry two cases, a total of three hundred and twenty thousand eggs. The native trout in these mountain lakes (elevation 10,000 feet) spawns from the 15th of June to the 15th of July. Thus the period for taking eggs is quite limited.

From the pack-horse, the cases of eggs are conveyed by wagon to the railroad, thence to the several hatcheries. From the time the eggs are placed in the cases, until they are in the hatcheries, they are kept at a temperature of 34° by ice and ice water poured over them during transit. Should the temperature in the cases rise, incubation starts and the eggs die in transit. The eggs we take from the rainbow and brook trout are handled in the same way when shipped green. We have no sub-stations large enough to eye eggs before transportation to the hatcheries.

The state has seven operative trout hatcheries, ample to stock all the waters of this commonwealth, and to im-

prove legitimate angling for all time to come. The work of operating the hatcheries by the collection of eggs from wild fish and the distribution of the fish has become a very important branch of the game and fish department. Hatcheries are expensive to operate, and competent fish culturists are scarce for stations already in commission. The present commissioner, believing in economy and efficiency, is encouraging the sportsmen's associations to build club hatcheries, at their own expense, along the most important streams of the state. During the past year, quite a number of such club hatcheries have been built by these fish and game associations. The method proposed is, that the state furnish the eggs from their field stations, and the members of the associations pay the expenses of a man to supervise the hatcheries and the distribution of the fish in the public waters. In this way people find that they can have all the fish they want in their districts by co-operative work. By this method the individual becomes personally interested in protection, which is an incident to propagation. Surely the lovers of sports afield and even the fish "hog" should be satisfied with this generous spirit, knowing that he, too, is assisting to make Colorado not only the playground of America, but one of the most famous sections for trout fishing that can be found in any of the states in the nation.

Distribution of the Trout

By handling the three different varieties of trout we keep our seven state hatcheries in operation throughout the year. This is why we are able to distribute annually from fifteen to twenty million fry.

With few exceptions, and that through accident or carelessness, we have no loss in our work—for example, we have taken young trout (fifty thousand eastern brook) in cans from water in the hatchery at forty-six degrees temperature, reduced the temperature slowly

down to 36°, carried them by rail a thousand miles and on a change of railroad line, thence 35 miles by wagon road to a mountain lake (10,000 feet elevation)—the trip in all lasting four days and four nights. During this time, the water was not changed in the cans, but by adding ice and pouring out the surplus water, we kept conditions so that the loss did not exceed 2% from transportation. None died but from natural causes. The lake in which they were placed was an artificial reservoir above the falls near timber line. It never had a fish in it and these brook trout grew to measure twelve inches in length in two years. That is one instance that proves how fish can be handled in transportation, even in ice-water, without loss at the time or thereafter.

In our lakes, the trouts feed on the young of the salamander or water dog, the leech, the fresh-water snail and the fresh-water shrimp. When abundance of the latter are found in our mountain lakes, the trout feeding on them, the flesh of the fish is red, and during the spawning season the male fish puts on the brightest scarlet colors on the belly and below the lateral line. This only in waters where this crustacean exists. In all waters where the fish diet is on the young of the salamander, or the young of the inferior varieties of fishes, as well as the hellgrammite and caddis fly, the flesh of this fish is either a pale yellow or white.

I find that the streams that flow from the Continental Divide to the Atlantic Ocean and through the great Utah Basin to the Gulf of California, contain the cutthroat trout and its sub-species with but two exceptions: the North Platte and the Powder rivers and their tributaries in Wyoming, the latter streams never had any trout of any kind in them naturally. Since my investigations in the '80's, these, as well as most other streams, have been liberally stocked with trout of the two varieties introduced—rainbow and brook, by the Wyoming hatcheries and the national fish commissions. During the years

1891 and 1892, the State Commissioner of Colorado placed many of the native trout in the headwaters of the North Platte in North Park, Colo., as well as the headwaters of the Big Laramie, in Laramie County, Colo.

In the headwaters of most all these mountain streams the cutthroat at the higher elevations has the habit of locating and is non-migratory, but remain there in those small mountain spring brooks all winter, when covered with snow from 5 to 10 feet. It does its feeding in the five summer months and practically hibernates in the cold water in winter. The individuals seldom grow to exceed 12 inches in length, and they invariably have a few medium large spots on the body back of the dorsal fin and above the lateral line, while the individuals of the same species which inhabit the rivers and large creeks of this region invariably have many more and much finer spots—the latter fish being much more migratory, going up in the spring high water to spawn, and down in the fall and winter when the water begins to recede. They vary with their surroundings, and, like their brothers in the upper waters, they can change their color to match the color of the bottom over which they live. As to the texture of their flesh, it is the finest of all, in hardness, flavor and quality. They are exquisite fishes. Their size depends on their food. When large, or of fair size, they are extremely gamey, especially in the swift waters of our Rocky Mountain streams. Therefore, to the disciples of Isaac Walton, the lovers of sports afield, and to all others, they are the trouts par-excellence of the Rocky Mountains.

[Mr. Land evidently confuses several different species under the one name, Black-spotted Mountain Trout. A part of what he says applies to one, a part to another and still other parts to other species.—*Editor.*]

DISCUSSION

MR. DANIEL B. FEARING, Rhode Island: I should like to ask the gentleman a few questions: Do I understand the speaker to say that that is an extraordinary size for the cutthroat trout?

MR. LAND: That is the Riversize. We caught those before there were any fish planted of that size in the Gunnison River, in 1882.

MR. FEARING: The reason I ask that question is that I have just returned from a trip through the Rocky Mountain Park in Canada; and in the Spray River there they have a native fish which they call a cutthroat. He looks as much like that fish as a mackerel looks like a trout. He is a bright silver, has the slightest trace of color in him, with black spots. Yet he is called the cutthroat trout in Canada; and is a native fish in all the Rocky Mountain preserves near Banff. An extraordinary size is considered to be two pounds. They catch thousands of them from 6 to 8, 10 and 12 ounces, and occasionally at the head waters they catch them up to two pounds; and then they think they are getting very large trout. The reason I ask is that he is so totally different from the fish you have exhibited.

MR. LAND: Do they have the markings on them?

MR. FEARING: Yes, very slightly. It is a silver-backed fish and is by no means the same shape as the fish shown by you.

MR. LAND: Where do these waters empty?

MR. FEARING: The Spray empties into the Bow River. They run down finally into the lakes. The Bow River finally ends in Lake Superior.

MR. LAND: I take it from Dr. Jordan that those fish have traversed only the Rocky Mountains. On one side they go into the Pacific; and the other side, as they get lower down———

MR. FEARING: The streams that I speak of are on the Atlantic side of the Great Divide.

MR. LAND: Yes.

MR. FEARING: They flow down, as I say, into Lake Superior. The Spray runs into the Bow and the Bow into Lake Superior.

MR. LAND: Yes, and I can refer to Judge Beaman to support my statement.

MR. FEARING: Is it the same fish?

MR. LAND: That I don't know—I never investigated those waters, but I will say this, that the sub-species are so different in markings that it is hard to distinguish them by means of spots. We know the Platte by their markings; and we know those tributary to the Colorado and Snake Rivers in the same way.

MR. FEARING: Professor Ward says they are a different fish.

PROFESSOR WARD: I think I quote Dr. Jordan correctly in saying that the term cutthroat trout applies to a group of trout and not to a single type or individual; and I recall distinctly that there is a great deal of intergradation and confusion between the different species. I had the pleasure last summer of fishing for three weeks in the Rio

Grande valley above Creede; and the cutthroat I caught there I could not myself reconcile with the book descriptions, which simply confirmed the statements that these different types are much confused and intergrade greatly at different points.

MR. FEARING: That is what I remember from my own reading and seeing that fish and the fish in Canada, I could not see how they were the same fish.

G. H. THOMSON, Colorado: On the coloration of the black-spotted cutthroat trout I would like to have a few words. I believe Dr. Jordan holds that there are 15 different varieties of that family. Now, I had a little experience in Estes Park just along this line. I will not call the gentlemen I refer to by name, because some of our Denver people might know him, but he has a place near Timber Line in Estes Park. He has a lake stocked with black-spotted trout. A year ago some parties came down to our hatchery, and, as I was exhibiting work in the hatchery, one of the gentlemen said: "Did you know that So-and-so has a different variety of the trout?" I said I did not. "Well," he said, "he has, and he is tickled to pieces over it; he said that he had a strictly different variety of the trout in that lake of his, although they were all put in there at the same time." This was in the month of July. I asked the party how he described them. "Well," he said, "there were some of them that were the ordinary color of the black-spotted trout, had their general colorings along the side, and the spots back of the dorsal fin, and the slash underneath the throat, of the cutthroat; and the others had that slash underneath the throat and underneath and clear to the top of the back, to the top of the dorsal fin,—they were as red as could be—a separate, distinct variety of the trout." Well, it amused me somewhat. I said: "Could he not tell you what the trouble was?" He said: "No." I said: "You go back and tell this party that his strictly new and beautiful trout is the male fish at spawning season, carrying its brilliancy to a high degree. The fish feed upon a red parasite or insect which gives the male more brilliancy than they otherwise would have. I never heard anything further of his new variety of trout.

I was glad Mr. Land in his paper pressed an invitation on you to visit our mountain streams. Now, gentlemen, I do not want you to forget for one moment, whether you have the opportunity at this time or at any other future time, that we have one of the prettiest places in Estes Park that you have ever visited. I am not going to try to describe it to you; I simply give you the invitation, and if you ever have an opportunity, come to Estes Park and see it for yourself.

Now, the question comes to all parties coming to our mountain districts for the summer, what is your fishing? It is not our mountain scenery that is the attraction altogether; but our fishing? Our Game and Fish Commissioner is stocking our streams with the three varieties of trout; and wherever you go in the Rocky Mountains you will find them in the streams. The higher up on the stream, the colder and

swifter the water, the more firm the flesh of the fish is, and they are all game fish.

I would like to ask Mr. Land just one question, if I may have the pleasure of doing so. He referred in his paper to the fish hog. I would like to know if he has found any proposition whatever that will satisfy the fish hog in fishing?

MR. LAND: Well, the fish hog is so universally known commercially and among sportsmen, that it is not necessary for me to speak in his favor or against him. I think we are trying to eliminate the fish hog as well as the game hog—ostracize him from civilization.

PROF. L. L. DYCHE, Kansas: Mr. Thomson made one remark which perhaps I did not quite understand. In referring to the sexes of the trout, he made special reference to the male as having a red stripe or red coloration on the back, where the female did not have any. Then I understood him to say this was due largely to a red parasite or insect that the fish fed upon. Is that right?

MR. THOMSON: Perhaps I did not make myself plain. Take our lakes in the high altitude, there is a red parasite or insect that our fish feed upon, giving the flesh a different color, more of a pink color, than the white, the natural color of the black-spotted trout; and it gives the male trout more of a brilliancy than he would otherwise have.

PROFESSOR DYCHE: What parasite is this, do you know?

MR. THOMSON: I am not prepared to say.

PROFESSOR DYCHE: Is it a parasite?

MR. THOMSON: It is insect life found in the water in the natural moss in these lakes; and you do not find it unless you go to a high altitude. Take the eastern brook trout in some of our lakes, at Timber Line, and many, as they catch them, declare that they are the salmon trout. This error is made simply because of the coloring of the flesh, due to the parasitic or insect food referred to.

MR. LAND: I will say, in answer to your question, Professor Dyche, that that is caused by the fresh water shrimp. The fresh water shrimp so impregnates the fish's flesh through the little globules of the crustacea, that it causes the fish to become very brilliant during the spawning season, especially the male, and sometimes the female, but principally the male; and wherever we find the fish of any kind in these mountain lakes feeding on the shrimp, the flesh becomes highly colored. The same holds true with regard to the salmon of the ocean. I believe it is the shrimp there that causes the change of color. I have taken fish from the lower elevations and put them in the lake and they become red, although they were pale and white before. Fresh water shrimps are found in abundance throughout the waters of the Rocky Mountain states.

MR. WILLIAM L. FINLEY, Portland Ore.: We have a great deal of difficulty in the identification of those trout in Oregon, and perhaps more than in some of the middle states, possibly it may be due to the fact that we have fish that come in from the ocean, sea-run fish and

other fish, that seem to stay in the headwaters and spawn. These sea-run cutthroats, or salmon trout, as they are generally called by the sportsmen, come into the rivers from the sea along through the late summer, and begin spawning in November and December. One feature is that these fish coming in, as far as I have observed, have lost almost entirely the red marking on the throat. I should like to ask whether in the spawning season that is the case with the trout in Colorado, whether they retain that marking during the entire period or not?

MR. LAND: I will say they do.

MR. FEARING: I would say to Professor Dyche that the coloration of the flesh had been abundantly proven in the case of Long Island trout. Take the case of the South Side Sportsman Club where they breed thousands of trout for their members, for many years previous to the last two years, those fish were fed on beef liver and hog's pluck's, and they were turned out weighing one-half pound and up, for the members to catch. But it is like fishing in a bathtub. The fish were so starved that they would bite anything, even a rag. But those fish bred up and fed in that manner were all white meated. Two years ago some of the members objected to the fact that the people they gave these fish to said they were not fit to eat, that they were soft and flabby;—it was the truth. Then they began feeding these fish on mummy chugs, shiners and all sorts of small fish caught in Great South Bay, and from that time on their meat gradually turned from white to pink. The brook trout that are wild in the southside waters are bright salmon colored, pink, and those fish feed on the fresh water shrimp and fresh water snails. Thirty-five miles below that location there is a club to which I belong, where the fish are wild and feed on shrimp, snails and larvæ, and the meat is red.

MR. W. E. MUSGROVE, Colorado: I have noticed that there was a greater variety in the color of eggs taken from fish than there is in the color of the flesh; and my theory is that the difference in the color of the fish comes from the different color of the egg from which the fish is hatched.

MR. C. K. CRANSTON, Oregon: I want to ask Mr. Fearing if the change in the diet of these bathtub fish he described improved the quality of the fish as to taste?

MR. FEARING: Absolutely—it made the fish fit to eat.

MR. CRANSTON: Were they as good as wild fish after this change in diet?

MR. FEARING: Very nearly,—yes, sir.

MR. MUSGROVE: I would like to relate a little experience I have had, and ask other members for the benefit of their experience. I have a number of lakes which are stocked with fry of the brook trout obtained from the Government hatchery at Leadville, and in transferring these fry from the hatchery to my lakes, until within the last few years I have usually had a loss of about 90% of the young fish.

I attributed this largely to the fact that in placing the young fry in the water of the larger lakes, where there was a superabundance of food, that they gorged themselves to death. This led me to construct at the head of each lake a small nursery, in which there was not any great abundance of food; and I turned the fish into these nurseries and retained them until they reached one to three inches in length, and then released them into the larger lakes. This system gave me better results, but I had one lake in particular on which shores were very precipitous, at an angle of 45°, and whilst I had transferred fish 3, 4 and 6 inches in length into that lake and they nearly all lived, whenever I transferred fish direct from the hatchery into this lake where these precipitous shores were, they invariably all died. I hardly ever saw one young fish after making this transfer. That was a mystery to me. For a number of years I could not find any solution of it; and finally it occurred to me that in transferring the fish from these shallow hatching boxes at the hatchery to the deeper water, the increased pressure on the bottom killed them. I recalled the circumstance of fish being brought up from the greater depths of the ocean to the surface for examination, and on reaching the surface they were all invariably dead. Well, now, I thought if that occurred in bringing them from the deep water to shallow water, why should it not occur in taking them from the shallow hatching troughs and transferring them to water which, within a few feet of where they were planted, was 25 or 30 feet deep. I thought this must be the cause of this great mortality. I studied the matter, and the more I studied the more evidence I could find, but only circumstantial evidence. I communicated with the U. S. Fish Commission at Washington, and they told me my theory was not correct, that the small fish were consumed by the larger fish in the water. But if there were any larger fish in the water at that time they knew more about it than I did. There were none, gentlemen. In transferring small trout fry from the hatching troughs to larger bodies of water there is usually a large percentage of loss. This loss is supposed, by those who do not closely study the conditions, to be due to the cannibalistic habits of larger trout. While cannibalism does prevail to some extent among all members of the trout family, I think they are accused of more in this line than the facts will justify and that the great mortality among newly planted small fry is caused more by unfavorable environment than by cannibalism. If any of you have had a similar experience I would like to hear it and to receive some corroborative evidence as to the correctness of my theory.

(Mr. Land here exhibited in small bottles preserved specimens of various insect life, which he described.)

MR. LAND: I just want to draw your attention to the insects that the trout live on, and to the fact that the same insect, the caddis fly, in its larval or gnit state, destroys the eggs and the baby trout. I show you here a specimen of a caddis fly. This fly throws a web around so that it can feed on 9 eggs. This was taken off the trays in the

hatchery; and then it will live on those eggs, until it changes from its larval state into the caddis fly proper. It is the larvæ that is consuming the eggs.

The next bottle I show you contains the caddis fly in the larvæ. The caddis fly is here rolled in its shell covered with sand; it throws a web around itself, rolls in the sand and makes a sand-covered shell; it covers itself with leaves or bits of wood, if it cannot find sand to collect on outside, gets under a flat rock, and stays there until changed from the chrysalid stage into the fly stage. They are eventually eaten by the larger trout, both in the larval and fly stage.

We have here millions of them; and that and other food is what supports the life of the fish, from the cradle in the baby stage to the grave—which that 10-pound fish means.

In this bottle is contained what is commonly called the hellgramite, but which is the stone fly; here it is the chrysalis from which it leaves its shell; and after it leaves its shell on the rocks it is a fly, reproduces and dies. The eggs hatch directly into the water, go among the stones, and being hatched become flies of various sizes, from half an inch long to as large as your thumb. They are known as the stone fly throughout the United States.

In the larger streams they are found as long as your thumb, and are known as the willow fly by sportsmen. Here is the diving bettle, the wolf of the waters, of all aquatic insects, in regard to the destruction of fish life. This beetle you see is in his larval stage. It has hard wings in the beetle state. Some of these beetles are found as large as your thumb. I found one inside of a 14-inch trout that had irritated the stomach of the trout so that the fish died. When I cut him open the beetle was undigested. The trout will not eat it if it is possible to avoid it, but they live in the mud and come up to the surface, casting a bubble, and go down into the mud; and if they find any weak trout in still waters, they consume them. As I say, they are the wolves of the water, for the young trout that are weak. Some time ago I received 25,000 grayling eggs of the grayling of Montana. I hatched them out and found out they could not be handled in a hatchery, and I transferred them to nursery ponds and saved about 5,000. In the nursery ponds I found that I did not have more than 2,000 grayling left, because they had been eaten by the diving beetle.

But I did raise grayling until they were 12 inches long, and kept them and raised them successfully and distributed them in the public waters.

The grayling of Montana have teeth the same as the grayling of Michigan, known as *Thymallus tricolor,* the grayling of Montana known as *Thymallus montanus,* and Alaska grayling as *Thymallus signifer.* I find the raising of any of the grayling impracticable for public waters anywhere in this state, in comparison with the same time devoted to trout.

The next thing our commissioner tried to introduce was the Rocky Mountain whitefish, which is commonly called the grayling by people in Colorado and some parts of Wyoming; but it is a misnomer. They have mouths like the whitefish, and we put them into troughs of the hatchery at Steamboat Springs, and hatch out 300,000. They are abundant in Bear River right alongside the trout; and when I took charge for a couple of months of that hatchery to continue the hatching and rearing of those grayling, I found it a failure, because they should be liberated like whitefish or hatched in jars. However, I saved some of them. We have them here in bottles, and I raised them to that stage. They lived without food for two months. I have kept trout without food, for experiment, in water 36° and kept them three months so that they were nearly starved to death. The whitefish would not feed—they all died off. So we have not yet succeeded in making a success of the reproduction of the Rocky Mountain whitefish. That is all I have to say, except to answer any questions that you may desire to ask.

MR. IGNATZ BALDUS, Indianapolis: At the fish hatchery I saw where they were feeding fish liver, lights and lungs, etc. Now, I believe that these fish when they get so that they will eat, would do better if they were put in ponds, where they could get natural food, same as they find in the wild stage, that you will have much stronger and healthier fingerling than under present conditions.

MR. LAND: We have adopted a plan that overcomes the difficulty of the feeding of fingerling in hatchery ponds for any length of time. We cooperate with the railroads and get them to build natural nursery ponds along the lines of their roads on the principal streams throughout this Rocky Mountain state. We turn fish over to them; they have men to look after them; they grow to fingerling size; and they are doing that now. That saves us from raising fingerlings in the hatchery. We cannot afford to raise fingerlings because we could not transport more than a few hundred in a can; while we can transport 2,500 fry such as you see in a hatchery; and two or three weeks they should be in the public streams. They live on microscopic food, and they live on the eggs of insects and on the insects themselves until they become big enough to become cannibals and live on the young of inferior fish. We find that they grow 50% faster after being taken out of troughs. Every fish in this hatchery will be distributed by the end of this month, and so with all the other hatcheries of the state; because we distribute the rainbow and the natives to make room for the brook trout hatch in the fall. We have three hatches a year and we cannot always put them in nursery ponds. Our water supply will not admit of it; but when we plant them in these lakes they live on natural food and do not die and are exterminated only by their enemies.

MR. CRANSTON: I want to inquire whether it is a matter of economy or whether it is the best policy that you are advocating. Suppose you

had money and water enough, so that you could keep the ponds clean and could feed them, would it not be better?

PRESIDENT: We do not want to get into the discussion of fingerling and fry. We have discussed that question for ten years.

MR. LAND (indicating on map of the United States): To illustrate this to you: Here is the State of Wyoming; draw a line across there, and there were no trout naturally to be found in all those waters that flow into the Atlantic Ocean. That has been all stocked by fry, but never any fingerling raised for planting. Here you have the State of Michigan; that is the whole of the southern part of the state which I have known since 1877, in trout and grayling culture; that has been stocked with rainbow trout and brook trout, all turned into public waters without sacs on, with sac absorbed, but because we lose more by keeping and feeding them. We keep a few of the young trout and raise them to fingerlings and turn them over to the railroad companies, because we want some waters stocked with larger sized fish for immediate result.

MR. C. W. WILLARD, Westerly, Rhode Island: I understand that Mr. Land said he was unsuccessful in introducing Montana grayling into public waters.

MR. LAND: My experiments proved unsuccessful.

MR. WILLARD: What is the reason?

MR. LAND: The fish cannot be fed and kept in hatcheries; they have to be turned out in nursery ponds where insect life is not destroyed, so that it is not profitable to try to introduce them anywhere except in their native habitat. The gentlemen from Michigan will tell you they are exterminated in that state because they put the trout in some of the Michigan streams and drove the grayling out of the Manistee River. There is only one part of Michigan now where the grayling are in a natural state, and there we found trout side by side with the grayling.

MR. WILLARD: Can you state the peculiar characteristics of streams that are necessary for the maintenance of grayling life?

MR. LAND: The only waters that I can call your attention to are the headwaters in Montana of the Yellowstone or Missouri. It is really the Madison River, the headwaters of the Missouri River, and in lakes and streams in Idaho. There you will find the grayling of Montana; the true American grayling were first found in Michigan in the Manistee and the Au Sable (*Thymallus tricolor*), and these are the only places we ever found the grayling, except in Europe. Now, the grayling is so tender that it is impossible to feed it in domestication; and I do not believe it is profitable to undertake to try and perpetuate the species of the grayling in preference to the trout. I think it is a waste of public money. It is very fine for the sportsman and the epicure who like the grayling, the fine texture of its flesh, etc., but unless we can have them brought down by the Government from Alaska and

try the grayling of Alaska, the larger size of grayling, I do not believe that it is worth while to even try to perpetuate the grayling.

PRESIDENT: The paper is an excellent one, but we are wandering from the subject of the discussion. We will discuss these subjects later in the question box.

MR. THOMSON: If that explanation had been made after the paper had been read it would have saved a lot of time.

PRESIDENT: I thought everybody knew that we had a question box, where we can discuss subjects not contained in the paper.

MR. H. D. DEAN, Anaconda, Mont.: At the proper time before the meeting is over, I would like to say something about the Montana grayling.

PRESIDENT: We had better take it up under a separate head, when we have the question box to consider.

MR. THOMSON: Let us abide by the question box.

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'10 VILES, BLAINE S., Inland Fish and Game Commissioner, Augusta, Me.

'00 VINCENT, W. S., U. S. Bureau of Fisheries, Tupelo, Miss.

'11 VIQUESNEY, J. H., State Game and Fish Warden, Belington, W. Va.

'00 VOGELSANG, ALEXANDER T., 20 Montgomery St., San Francisco, Cal.

'12 VOGT, JAMES H., Nevada Fish Commission, Carson City, Nev.

'09 VON LENGERKE, J., 200 Fifth Ave., New York City.

'06 WADDELL, JOHN, Grand Rapids, Mich.
'96 WALKER, BRYANT, Detroit, Mich.
'11 WALKER, DR. H. T., 210 Main St., Denison, Texas.
'03 WALLICH, CLAUDIUS, U. S. Bureau of Fisheries, Concrete, Wash.
'96 WALTERS, C. H., Cold Spring Harbor, N. Y.
'98 WARD, DR. H. B., University of Illinois, Urbana, Ill.
'12 WARD, J. QUINCY, Executive Agent, Kentucky Game and Fish Commission, Frankfort, Ky.
'92 WEBB, W. SEWARD, 44th St. and Vanderbilt Ave., New York City.
'12 WEBER, E. D., P. O. Box 81, Littleton, Colo.
'07 WEBSTER, B. O., Wisconsin Fish Commission, Madison, Wis.
'12 WEHLE, O. C., 5471 Kimbark Ave., Chicago, Ill.
'01 WENTWORTH, E. E., U. S. Bureau of Fisheries, Concrete, Wash.
'12 WENTWORTH, NATHANIEL, Fish and Game Commissioner, Hudson, N. H.
'01 WHEELER, CHARLES STETSON, Union Trust Building, San Francisco, Cal.
'02 WHISH, JOHN D., Albany, N. Y.
'04 WHITAKER, ANDREW R., State Fishery Commission, Phoenixville, Pa.
'96 WHITE, R. TYSON, 320 Bridge Street, Brooklyn, N. Y.
'10 WHITMAN, EDWARD C., Canso, Nova Scotia, Canada.
'11 WIDMYER, EDGAR R., U. S. Bureau of Fisheries, Homer, Minn.
'89 WILBUR, H. O., 235 Third St., Philadelphia, Pa.
'99 WILLARD, CHARLES W., President Inland Fisheries Commission, Westerly, R. I.
'01 WILSON, C. H., Glens Falls, N. Y.
'11 WILSON, J. S. P. H., Chairman, Board of Inland Game and Fish Commissioners, Auburn, Me.

'10 WINCHESTER, GRANT E., Forest, Fish and Game Commission, Bemus Point, N. Y.
'00 WINN, DENNIS, U. S. Bureau of Fisheries, Oregon City, Ore.
'99 WIRES, S. P., U. S. Bureau of Fisheries, Duluth, Minn.
*'05 WOLTERS, CHAS. A., Oxford and Marvine Streets, Philadelphia, Pa.
'97 WOOD, C. C., Plymouth, Mass.
'11 WORTH, HENRY B., U. S. Bureau of Fisheries, Washington, D. C.
'84 WORTH, S. G., U. S. Bureau of Fisheries, Orangeburg, S. C.
'10 WURZBURG, L., Ketchikan, Alaska.

'09 YERINGTON, EDWARD B., Board of State Fish Commissioners, Carson City, Nev.
'10 YOUNG, CAPT. CARL C., 2 Mt. Vernon St., Gloucester, Mass.
'06 YOUNG, CAPT. JOHN L., Atlantic City, N. J.

'99 ZALSMAN, P. G., Wisconsin Fish Commission, Wild Rose, Wis.

Recapitulation

HONORARY	76
CORRESPONDING	18
ACTIVE (including life members)	533
TOTAL MEMBERSHIP	627

CONSTITUTION

(As amended to date)

ARTICLE I

NAME AND OBJECT

The name of this Society shall be American Fisheries Society. Its object shall be to promote the cause of fish culture; to gather and diffuse information bearing upon its practical success, and upon all matters relating to the fisheries; the uniting and encouraging of all interests of fish culture and the fisheries, and the treatment of all questions regarding fish, of a scientific and economic character.

ARTICLE II

MEMBERS

Any person shall, upon a two-thirds vote and the payment of two dollars, become a member of this Society. In case members do not pay their fees, which shall be two dollars per year after the first year, and are delinquent for two years, they shall be notified by the treasurer, and if the amount due is not paid within a month thereafter, they shall be, without further notice, dropped from the roll of membership. Any person can be made an honorary or a corresponding member upon a two-thirds vote of the members present at any regular meeting.

The President (by name) of the United States and the Governors (by name) of the several states shall be honorary members of the Society.

Any person shall, upon a two-thirds vote and the payment of twenty-five dollars, become a life member of this Society, and shall thereafter be exempt from all annual dues.

ARTICLE III

OFFICERS

The officers of this Society shall be a president and a vice-president, who shall be ineligible for election to the same office until a year after the expiration of their term; a corresponding secretary, a recording secretary, an assistant recording secretary, a treasurer, and an executive committee of seven, which, with the officers before named, shall form a council and transact such business as may be necessary when the Society is not in session—four to constitute a quorum.

In addition to the officers above named there shall be elected annually five vice-presidents who shall be in charge of the following five divisions or sections:

1. Fish culture.
2. Commercial fishing.
3. Aquatic biology and physics.
4. Angling.
5. Protection and legislation.

ARTICLE IV

MEETINGS

The regular meeting of the Society shall be held once a year, the time and place being decided upon at the previous meeting, or, in default of such action, by the executive committee.

ARTICLE V

ORDER OF BUSINESS

1. Call to order by president.
2. Roll call of members.
3. Applications for membership.
4. Reports of officers.
    a. President.
    b. Secretary.
    c. Treasurer.
    d. Vice-Presidents of Divisions.
    e. Standing committees.

5. Committees appointed by the president.
   a. Committee of five on nomination of officers for ensuing year.
   b. Committee of three on time and place of next meeting.
   c. Auditing committee of three.
   d. Committee of three on programme.
   e. Committee of three on publication.
   f. Committee of three on publicity.
6. Reading of papers and discussion of same.
   (Note—In the reading of papers preference shall be given to the members present.)
7. Miscellaneous business.
8. Adjournment.

ARTICLE VI

CHANGING THE CONSTITUTION

The constitution of the Society may be amended, altered or repealed by a two-thirds vote of the members present at any regular meeting, provided at least fifteen members are present at said regular meeting.

TRANSACTIONS

OF THE

AMERICAN FISHERIES SOCIETY

597.06
A512
V.42

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